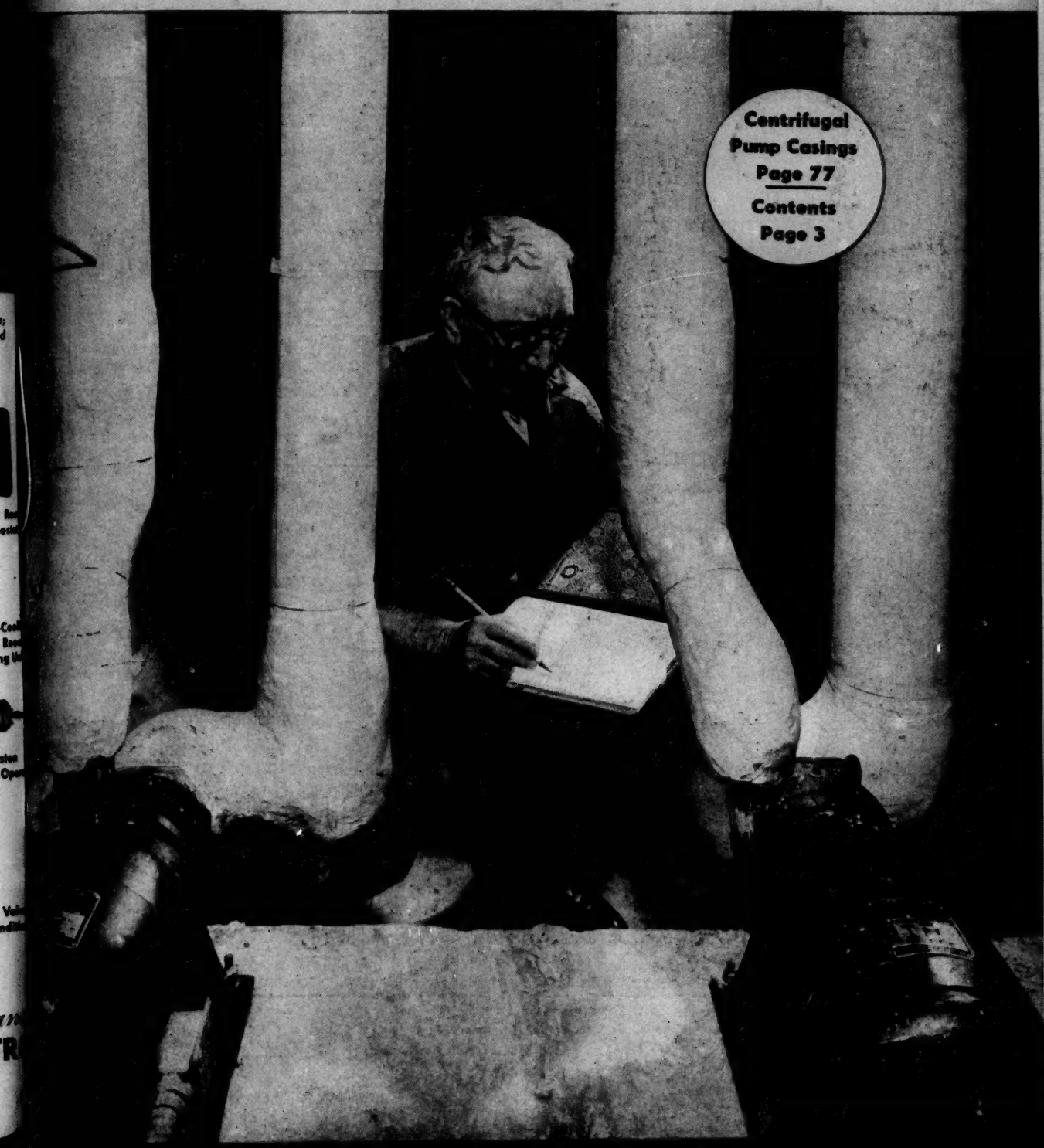
HEATING AND VENTILATING

LUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



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East Branch, National Bank of Pottstown, Pa. Note Webster Walvector blanketing large window area and spreading heat along exposed walls. Howell Lewis Shay, Architects. E. A. Vanderslice, Engineer. Rodney Morris & Son, Heating Contractor. Warren B. Zern, General Contractor.

Air Conditioning AND Tru-Perimeter Heating . . .

A good team for COMFORT all year long!

Twin branch banks team complete air conditioning with winter-long comfort of forced hot water Webster Tru-Perimeter Heating.

Whether it's the dog days of summer or the polar bear months of winter, there's complete comfort inside the new, matching East and West Branches of the National Bank of Pottstown, Pa. That's because Howell Lewis Shay, Architects, designed them with comfort in mind . . . specified air conditioning *plus* forced hot water Webster Tru-Perimeter Heating.

Trim, attractive Webster Walvector, tucked beneath the large window area and along all exposed walls, carries forced hot water heat around the perimeter of the building . . . replaces heat where heat loss occurs . . . spreads heat gently and evenly for draft-free comfort.

Webster Walvector in Tru-Perimeter Heating is economical to install and maintain. Simplified piping is easily accessible . . . fewer risers are needed. Heating up is quick, and effectively controlled.

Webster Tru-Perimeter Heating with series-connected Webster Walvector uses forced hot water or Moderator controlled low-pressure steam. For further information, call the Webster Representative or write us.

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For Steam or Hot Water Heating

AND **Webster Heating Equipment also includes Webster Baseboard also used in Tru-Perimeter Heating; Convectors; Steam Heating Specialties for heating and process applications; Webster Moderator Systems of Steam Heating and continuous flow controls for hot water heating — both with Outdoor Thermostat; steam, hot water and gas Unit Heaters. Data on request.**

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, PLUMBING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

JULY, 1954

VOLUME 51—NO. 7

The Cover: Maintenance engineer checks operation of Worthington pumps in a chilled water circulating system.

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Washington News

LORING F. OVERMAN

THE next few weeks are the ones to watch as Members of Congress turn into the home stretch and make a dash to cross the finish line of an August 1 adjournment. It is in times like these, with tempers short and deadlines nearing, that legislation which might not stand minute inspection is hurried through in the interest of "getting something done."

Individuals, companies, or industries having an interest in pending legislation (and who hasn't?) will do well to keep Senators and Congressmen informed of constituents' wishes. It is not safe to assume that a wanted measure will carry through on its own power, nor that undesirable legislation will remain dormant. Not until the last minute of adjournment day can one be certain of the record of the 83rd Congress, Second Session.

Meanwhile, what goes on in Washington that may be of particular interest to those of the heating, ventilating and air-conditioning industries?

What of Indochina?

At this writing, the subject of Indochina is still the unwelcome guest at the Washington conference table. Nearly all Capitol decisions, whether they involve taxes, budgets, military programs or domestic economy, must take into consideration the possibility of United States involvement in hostilities.

Plans for government control of prices, wages, salaries, and rents were drafted more than a year ago by the Office of Defense Mobilization as a precautionary step. At that time it had no direct connection with Indochina. Legislation authorizing the imposition of such controls could be enacted within days.

The possibility of war, shortages, and controls does not make for pleasant thoughts, but in the present era it is wise for management to keep the business house in order.

Industrial Defense Stressed

That Defense people are deadly serious about "being prepared", was amply apparent during the Industrial Defense Conference held June 15 in Washington under sponsorship of the United States Chamber of Commerce. Five government speakers outlined the problem and urged industry to cooperate.

Dr. Arthur S. Flemming, Defense Mobilization Director said that dispersal of essential production facilities is one of the major aspects of the problem of keeping the mobilization base secure. He announced that as a new policy to encourage the removal of essential plants out of target areas, ODM would give consideration to applications for rapid tax amortization. The idea has been under study for several months, and the inducement can be offered only under exceptional circumstances, Dr. Flemming explained. He reminded conference delegates that the ODM is already offering 100% tax write-offs for protective construction to take care of men and machines if it is impracticable to consider dispersal. Although the ODM recommends duplicate records and tooling, and duplicate industry command posts, no promise of rapid tax amortization for such a purpose has been made.

Donald A. Quarles, Assistant Defense Secretary for Research and Development cited our Pacific tests of the H bomb as sufficient reason for taking dispersal talk seriously. "Our Pacific Tests indicated a total destruction area six miles across, and over 150 miles of severe to moderate damage", he said.

Federal Civil Defense Administrator Val Peterson urged industry to participate in local civil defense programs. "Above all," Administrator Peterson said, "remember that there is no umbrella of protection that will spare your plant if others in the community go up in flames. We are dealing today with areas of possible enemy-caused destruction that are measured not in blocks, but in square miles."

Lieutenant General Willard S. Paul, retired, Assistant ODM Director for Non-Military Defense, told of the activities of an Inter-Agency Industrial Defense Committee which meets at least once a month in Washington to compare agency experience and progress, and to outline policies. Another group, the Facilities Protection Board, established by Presidential Executive Order, assists ODM in the development of technical standards and programs for the physical security of the most important industrial and government facilities.

The thoroughness with which the problem is being faced is indicated by General Paul's comment that the Federal Reserve System and Treasury Department are "responsible jointly for development of a fiscal program which will meet the major immediate problems in the monetary and credit field which will be encountered under large-scale disaster."

Charles F. Honeywell, Administrator of the Business and Defense Services Administration, explained the three-phase work of his agency. "We think of industrial defense", he said, "in terms of three distinct levels of activity—the industry level, the company, or management level, and the plant, or facility level. Many problems require industry-wide handling, through a trade association or other industry organization. The greater part of industrial defense must be done by the owners and managers of the nation's industrial facilities. The existence of so many multi-plant companies has brought about a considerable delegation of authority to plant managers. Plant management should look to top management to set minimum standards. And management must have the assurance that effective measures are being applied at the plant level."

Administrator Honeywell explained that BDSA has 550 Industry Advisory Committees, 25 of which have met since the agency's creation last October. In addition, industry conferences involving top executives of 22 different industries have also been held. Mr. Honeywell urged all defense industries to take advantage of the facilities of his agency for making thorough, comprehensive surveys of industrial defense problems.

To close the somber conference, one representative of

Little Drops of Water (Condensation) Ruined a Fine Home---Cost over a Million Dollars to an Apartment Development

They thought they would move their fine country home to a new site. The state highway was coming through. They could not! Account of condensation inside the walls, the sills had rotted away.

The owners of a path-breaking apartment house development in a great city had to pay a repair bill of more than a million dollars for ripping out condensation-soaked insulation and replacing damaged, plaster walls.

Today's tightly-built, high humidity houses create new problems of vapor pressure and vapor retention within. Sometimes excessive flow of vapor into building spaces occurs, and the formation of destructive condensation is enhanced, where a vapor barrier is lacking from the insulation or there is one with too many breaks in it, or one which while waterproof is not vapor-proof.

But there now is a new multiple accordion aluminum which forms a continuous, edge-to-edge blanket of uniform depth between studs or joists, giving the entire area maximum protection against condensation formation as well as against heat loss or intrusion.

Multiple accordion aluminum's surfaces have high radiation or heat ray reflectivity (97%); low absorptivity (3%); and low emissivity (3%). Conduction is low because of preponderant air spaces of low density. Aluminum and fiber layers retard convection, outer and inner.

The aluminum sheets, 500 ft. and 750 ft. long, are impervious to water vapor. Infiltration under the flat, stapled flanges is slight. Condensation formation on or within this type of insulation is minimized by the scientific construction of multiple layers of accordion aluminum, fiber and air spaces. The commercial form of multiple accordion aluminum is Infra Insulation, Types 6-S and 4-S.

The U.S. NATIONAL BUREAU OF STANDARDS has made an interesting study of condensation in walls of dwellings, and has published a pamphlet entitled: "Moisture Condensation in Building Walls." Obtain a copy at our expense by using coupon.

COST OF INFRA INSULATION INSTALLED in new construction between wood joists, material with labor,

Type 6-S under 9½¢ sq. ft.

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industry told what his company is doing to comply with ODM requests. He was John H. Redmond, Assistant Production Manager of The Koppers Co., Inc.

"The only absolute protection for industry in wartime is to go underground" said Mr. Redmond. "However, the cost of doing so would be prohibitive. In order to obtain maximum protection at reasonable cost and in the shortest time, a phased program has been placed in effect. The first phase consists of doing the most with what we have. It is a screening and training of personnel program with provision for protection by using existing shelters. The second phase deals largely with planning and recommendations from plants for additional protection. It is not planned to go much beyond the planning stage until the possibility of attack on any individual plant is more clearly defined than it is possible to define it now. The third and final phase deals with procedures in the event of a declaration of war by the United States."

On The Credit Side

Yet all is not gloom in Washington. In the construction field, for example, Government estimators now figure that spending for new buildings and public works will reach a record $36 billion this year. This forecast is 2% higher than actual expenditures in 1953, and 6% above the initial estimate of $34 billion for this year.

In the private residential field, hotels and non-housekeeping units are up 12%; industrial, down 13%; warehouses and offices, up 22%; social and recreational, up 32%; churches, up 11%. In public housing, residential is down 37%; schools up 16%.

The fact that privately built dwellings are up only 1% over last year is somewhat offset by a new development, the growing popularity of home air conditioning.

Washington a Proving Ground

Washington, D. C., is currently being test-marketed by the nation's top manufacturers of residential air conditioning equipment. Although it is conceded that the city has a climate capable of making every resident a prospect for air conditioning, there is another reason why newspapers here are carrying 20-page sections devoted exclusively to home air conditioning.

Washington is more than just a residential city. Instead it is the temporary home of thousands of Government people who maintain contacts with the folks back home. It is the mecca for millions of tourists. It is visited by Members of Congress and constituents from all parts of the United States, and representatives of foreign countries.

A sales story told in Washington newspapers is quite likely to be seen in Pocatello or Walla Walla. So the current interest in home air-conditioning is significant. With ads and news stories pointing out that packaged home conditioners are available "as low as $995", it becomes apparent that a residential market of any size would be worth going after.

So they're predicting in Washington that air-conditioning will change the design of the average home before long. Fantastic? Not at all. Only a few years ago, the automobile added garages to or under the house. More recently the carport is the architect's bow to the motor car. And last but not least, the automobile moved entire cities out into the country.

So Washington writers are picking up the idea that architects should anticipate air-conditioning by increasing the overhang of roofs; by providing adjustable jalousies, windbreaks, shade, and proper insulation. In addition, they are forecasting that by 1958, installations of complete central systems will have reached nearly two-thirds of a million units annually. By 1963, the forecast says, they'll be going into houses at a rate exceeding 1,250,000 installations annually. This means that only five years hence there will be nearly two million single-family homes equipped with year-round conditioning, not including large apartment house air conditioning systems. By then the non-air-conditioned house will have started down the long road to obsolescence.

Home air conditioning, the stepchild of the industry, may yet turn out to be its Cinderella and become very outstanding.

Washington Miscellany

1,300 New Customers. Thirteen hundred rural families in eight states will soon have electric power for the first time to operate fans, air conditioners, oil burners and other electrical equipment. Service is provided for by $2,290,000 in loans for distribution equipment, approved by the Rural Electrification Administration. Communities involved are Breese, Ill.; West Point, Neb.; St. Paul, Neb.; Columbus, N. M.; Wake Forest, N. C.; Huntingdon, Pa.; Worland, Wyo.; Sullivan, Ind.; Tekemah, Neb.; Ladysmith, Wis.; and Marietta, Ohio.

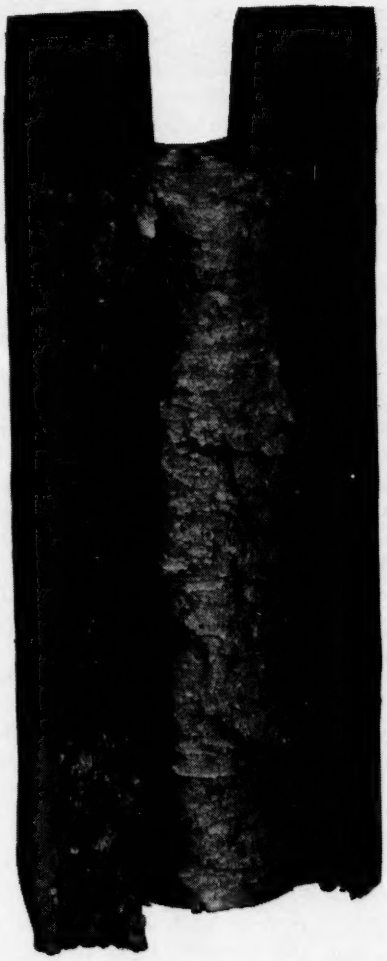
Pipeline Safety Rules Sought. The House Commerce Committee is considering legislation (H.R. 134), which would give the Federal Power Commission authority to establish safety standards for natural gas pipelines. The bill, unopposed, was favored by state power officials, the American Standards Association, and the Federal Power Commission itself. The FPC statement said, in part: "The only standard guide now generally available for construction and operation of natural gas pipelines is the Code of Pressure Piping, published in 1942, under sponsorship of the American Society of Mechanical Engineers, and endorsed by the American Standards Association. Though several minor revisions have been made in the code since 1942, it still does not provide adequate standards for modern high-pressure transmission pipelines. Nor is its observance compulsory.

"In the last few years the natural gas industry has undergone a tremendous expansion program. The American Standards Association is now completing revision of safety standards for the industry suitable for modern practices. If adopted, there would be little difficulty in securing compliance."

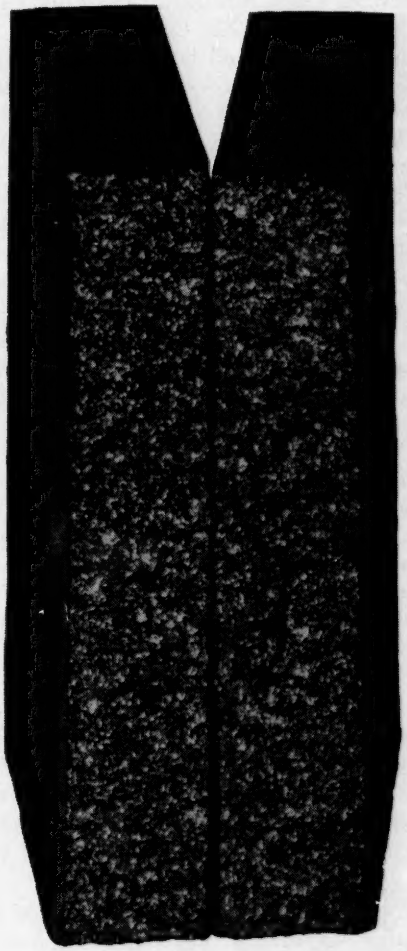
Pipe Line Company Revenues Up. Operating revenues of natural gas pipeline operating companies was up 22.6% during the 12-month period ending February 1954, compared with the comparable period for 1952-53. Revenue in February of this year was 17.1% ahead of the same month in 1953.

Mines Experiment Station Ready. At presstime, the new Bureau of Mines experiment station at Morgantown, W. Va. was about ready to take over several fuel research and safety projects which have been operating at other locations. The new laboratories, office buildings and other facilities required were authorized by Congress in 1950, and started in 1952.

HERE IS THE DIFFERENCE



WROUGHT IRON



STEEL

These are actual photographs of fractured pieces of wrought iron and steel. The picture at the left shows the fibrous structure of wrought iron. How this differs from the crystalline structure of steel is readily apparent. It is the presence of many thousands of tiny threads of glass-like iron silicate that gives wrought iron this unique fibrous structure and it is this structural feature, duplicated in no other metal, that gives wrought iron its superior resistance to corrosion and fatigue stresses.

While the initial cost may be higher, actual service records in numerous applications prove that wrought iron is the most economical buy because it lasts longer. Ask any Byers Field Service Engineer to show you fractured pieces, similar to those illustrated above. Write for our booklet, "The ABC's of Wrought Iron."

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Department: New York, N.Y.

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CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY STEEL PRODUCTS

BRIEFLY STATED

• The Public Utilities Commission of Ohio, for the first time in several years, has lifted practically all controls over gas space heating. The Commission said its order meant most Ohioans would be able to install gas heating plants for next winter—provided they file written applications and provided they live in areas already served. The order made no differentiation between conversion burners and new gas furnaces. However, the Commission did leave full controls temporarily in effect in the Newark and Defiance areas, with the hope that additional supplies might be obtained during the summer. Relatively minor controls were left on the use of natural gas for heating commercial and industrial establishments.

• The appointment of George S. Chappars to the newly-created post of director of advertising and public relations for Robertshaw-Fulton Controls Co. has been announced. Mr. Chappars will be located at the Greensburg, Pa., executive offices of the national controls and instrument manufacturing firm. Mr. Chappars was formerly an account executive in the public relations department of Ketchum, MacLeod & Grove, Pittsburgh advertising agency, and previous to that was a member of the advertising department of Armco Steel Corp., Middletown, Ohio.

• Joseph J. Friedler, Jr., has been named vice-president in charge of sales for Ilg Electric Ventilating Co., Chicago. Mr. Friedler has been associated with the firm since 1925 and has served as southern district manager in New Orleans since 1930. He has been a director since 1946.

• John W. Gingerich has been promoted from assistant merchandising manager to merchandising manager of York-Shipley, Inc. In this new position, Mr. Gingerich will direct the advertising and marchandising of all York-Shipley divisions. He joined the York-Shipley organization three years ago as advertising manager of the Shipley Cooling & Heating retail division. Six months later, he became assistant merchandising manager. Before joining York-Shipley, Mr. Gingerich served for two years as production manager of the W. H. Long Co., Inc., York, Pa., advertising agency for York-Shipley, Inc.

• Jack Searls has been appointed assistant to the vice-president and director of sales, Penn Controls, Inc., Goshen, Indiana. Mr. Searls was formerly general sales manager, Morrison Steel Products, Inc., Buffalo, New York. He has more than 15 years experience in the field of control application, sales and application of controls for heating, air conditioning, refrigeration, gas appliances, pumps, air compressors, and engines.

• Young Radiator Co., Racine, Wis., has announced the appointment of Arthur E. Slaasted as advertising and sales promotion manager. Before joining Young Radiator, Mr. Slaasted was advertising coordinator of power and electronic equipment, Allis, Chalmers Mfg. Co., Milwaukee.

• Selection of Stone & Webster Engineering Corp., Boston, Massachusetts, to perform architect-engineering services associated with the design of the nuclear portion of the pressurized water reactor (PWR) project to be constructed at a site near Shippingport, Pa., has been announced by the Atomic Energy Commission. Stone & Webster will be a subcontractor under the Westinghouse Electric Corp. which has responsibility for development, design and construction of the nuclear portion of the project under its prime contract with the Commission. As the Commission has previously announced, the turbine-generator portion of the plant will be designed and constructed by the Duquesne Light Company of Pittsburgh, Pennsylvania. The subcontract with Stone & Webster will provide for the reimbursement of actual costs from Government funds and the payment of a fee of $1.00 for services rendered.

• American Air Filter Co., Inc., has purchased the entire plant and equipment of Ice Cooling Appliance Corp., Morrison, Ill. Ice Cooling, a subsidiary of City Products Corp., Chicago, manufactured ice refrigerators, freezers, soft drink coolers, and vending machine parts. The 152,000 square foot Morrison plant will be operated by AAF's Herman Nelson Division, Moline, Ill., which produces heating and ventilating equipment. In full production the Morrison plant will employ approximately 200 people. Employment in the Division's Moline plant will be maintained at its present level or higher.

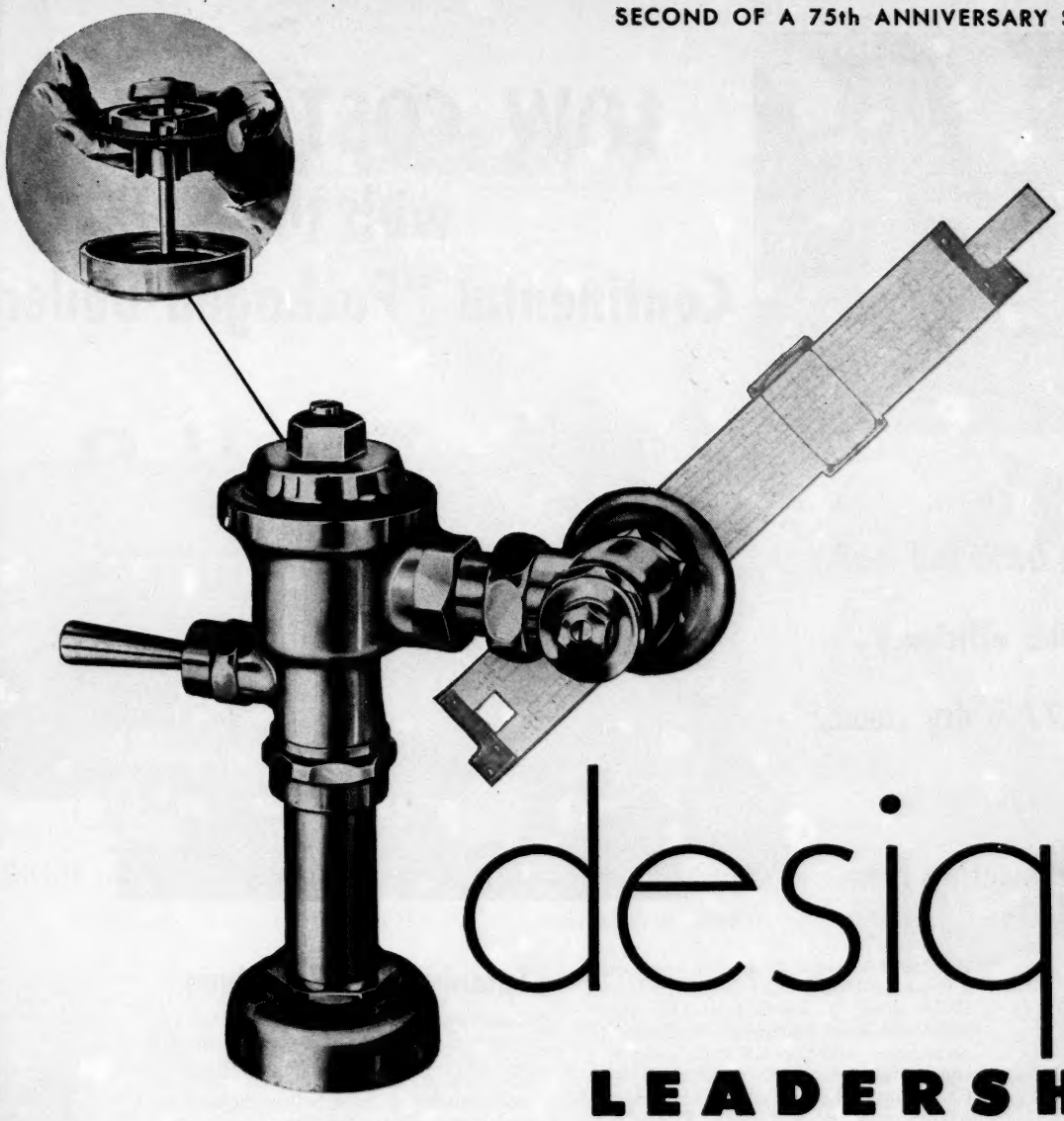
• The Syracuse, N. Y., facilities of Carrier Corp. will be improved and rearranged in order to make possible a 75% increase in the production of room air conditioners and to meet increasing demands for heavier air conditioning equipment.

• Worthington Corp. has moved its New York executive headquarters and New York district sales and export offices to larger quarters at 99 Park Avenue. The recently completed building, aluminum clad and modern in design, is air conditioned throughout by Worthington central station equipment.

• Gustin-Bacon Manufacturing Co. has announced the appointment of G. P. Oldham to the position of general sales manager. Mr. Oldham succeeds F. H. Ebbert, vice president, who has been assigned other executive duties. For the last six years Mr. Oldham has been associated with Kaiser Aluminum and Chemical Corp. in executive sales capacities.

• Bush Manufacturing Co. and its wholly-owned subsidiary, Heat-X-Changer Co., have anounced the opening of a new plant in Riverside, Cal.

• C. A. Pickett has been elected vice president of Illinois Engineering Co., Chicago, manufacturer of steam heating and power specialties and control systems. Mr. Pickett has served as general manager of Illinois Engineering since the company was acquired by American Air Filter Company, Inc., Louisville, Ky., in 1953. John Hellstrom, vice president and director of sales of American Air Filter Company, and Mr. Pickett were also elected directors of Illinois Engineering Company.



design LEADERSHIP

In the development of DELANY FLUSH VALVES the primary aim has been the concept of simplicity. Accordingly, for those who have lived with a COYNE & DELANY installation, there can be no other flush valve. Shown above is one of several deciding factors — the interior working assembly of a DELANY VALVE. Only six component parts comprise this assembly — a maintenance advantage obtainable today only in a diaphragm type valve. Removing the valve cover immediately identifies any source of difficulty, and replacements, if necessary, are accomplished inexpensively, instantaneously — and infrequently. For more detailed flush valve and vacuum breaker data contained in Handbook and Catalog 53, write Engineering Department, COYNE & DELANY CO., 834 KENT AVE., BROOKLYN 5, N. Y.

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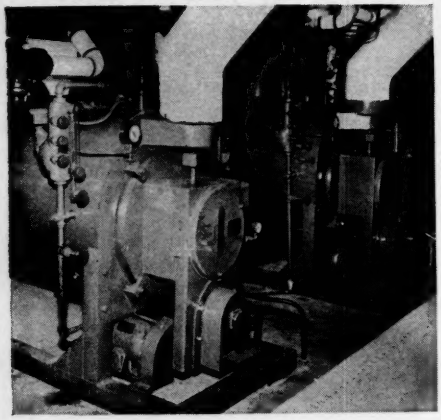
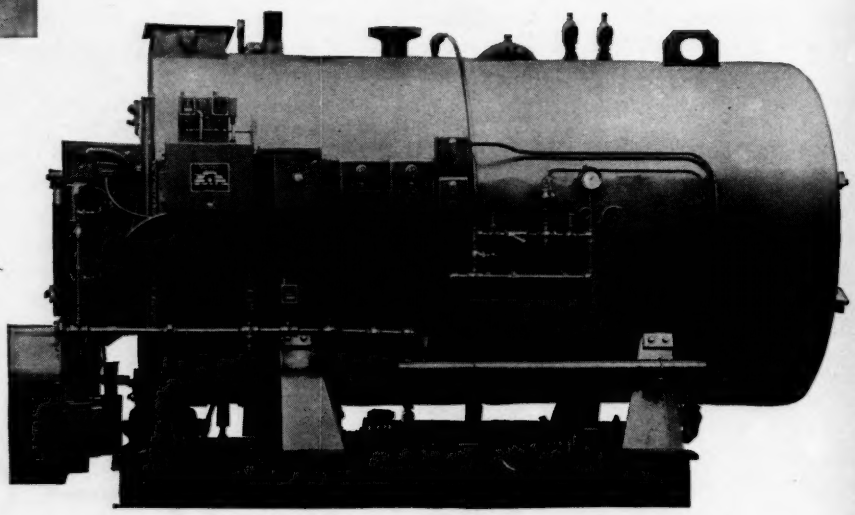


LOW COST STEAM
with the Continental "Packaged Boiler"



84.08% full load boiler efficiency... 99.77% dry steam reported by engineering firm

A consulting engineering firm conducted a test on a 150 hp Continental Automatic Boiler firing Bunker C Fuel Oil, under simulated field operating conditions in accordance with the A.S.M.E. boiler test code. The results give proof as to why Continental Boilers afford high steam quality and low fuel costs. As the test showed: steam quality was 99.77% dry ... full load boiler efficiency was 84.08% ... and stack temperature was considerably less than 100 degrees (F.) above steam temperature.

The consistently high efficiency and low stack temperature of the Continental Boiler are due mainly to ample heating surface, thorough mixing of atomized fuel and air, and the spinning gas technique.

Spinning Gas Technique

Continental's spinning gas technique retards the passage of hot gases through the furnace and return tubes – thus affording an exceptionally high rate of heat transfer ... high boiler efficiency ... and low stack temperature.

With the Continental, efficiency over 80% is *guaranteed* ... and stack temperature is *guaranteed* not to exceed 125 degrees (F.) above saturated steam temperature at operating pressure.

Continental Automatic Packaged Boilers range from 20 to 500 hp; 15 to 200 lbs. W.P.

Write for new Bulletins BE3, BE4 and a copy of the boiler test report.

Bulletin BE3 ... tells what to look for when you select a packaged boiler.

Bulletin BE4 ... describes the Continental's Spinning Gas Technique.

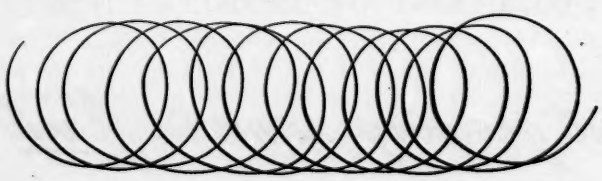
Continental Boiler Division

BOILER ENGINEERING & SUPPLY CO., Inc.

Phoenixville, Pennsylvania

40 years of boiler manufacturing experience

Continental is sold, installed and serviced by competent distributors throughout the U.S.



... the boiler with the Spinning Gas Technique

AIRMAT PL-24

THE *Multi-Million* AIR FI

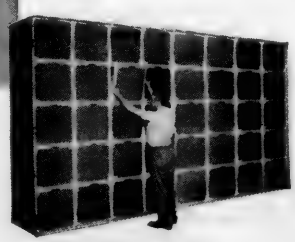
SINCE its introduction in 1936, over 225,000 units of this AAF dry filter, totaling one-quarter billion cfm capacity, have been installed.

All types of business use the PL-24 for all types of air cleaning service. The reasons—the highest cleaning efficiency of any commercial unit filter; simplified maintenance eliminating oil or water for washing.

The Type PL-24 is sturdy and compact—provides 28 sq. ft. of effective filtering area in a unit 2′ x 2′ x 8″. The efficient Airmat paper filtering media, being low in cost, is quickly replaced when soiled—cutting maintenance cost and returning filter to initial resistance and original condition. Unit construction simplifies installation for any capacity requirements.

Yes, in design, performance and acceptance, the Airmat PL-24 is definitely a multi-million*air* filter. For complete product information, call your nearest AAF representative or write for Bulletin No. 230.

AAF



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COMPANY, INC.

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American Air Filter of Canada, Ltd., Montreal, P. Q.

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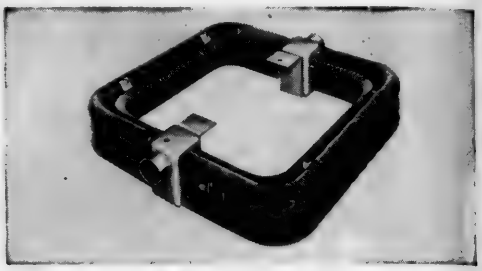
NEW! Venturafin Vertical Unit Heaters for ceiling-

(58,400 to 560,000 BTU at 2 lbs. steam pressure and 60° F. entering air)



Copper coils for efficient heat transfer

Non-ferrous fins, spirally wound on seamless copper tubing, give efficient, economical heat transfer. Ample spacing between fins cuts clogging from dust, dirt.

EQUITEMP AIR DIFFUSER LETS YOU

High ceilings

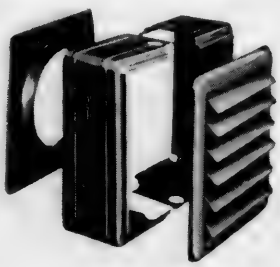
Average ceilings

NEW! Venturafin Horizontal Unit Heaters for wall-

(18,000 to 357,500 BTU at 2 lbs. steam pressure and 60° F. entering air)

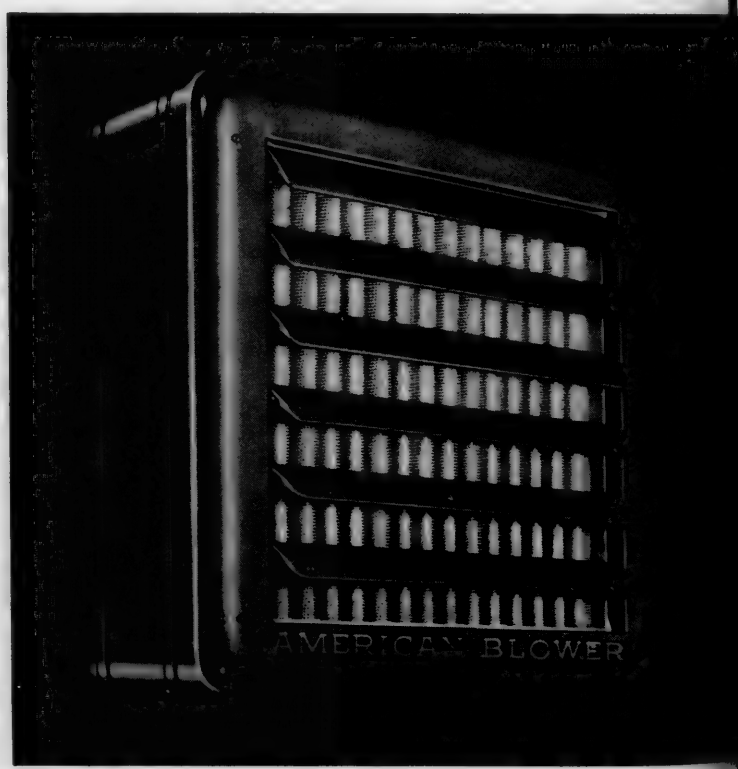
Casings of steel for long life

Steel casings are finished in baked enamel; hardware is cadmium plated. Die-formed horizontal louvers are standard; louvers available in other arrangements for special needs.



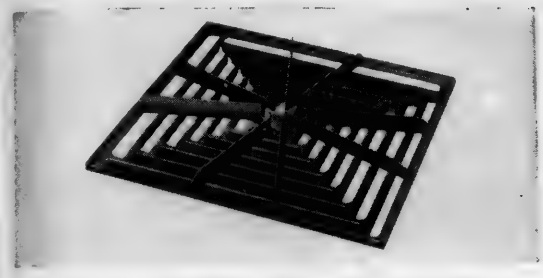
Fans strengthened against de-pitching

Fan wheels are rigidly constructed for maximum efficiency, quiet operation. Blades are of heavy-gauge aluminum, with strengthening beads to eliminate de-pitching under load.



Blower Venturafin Unit Heaters

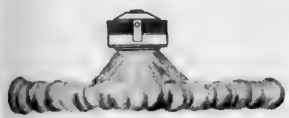
to-floor heating



Equitemp Air Diffuser for uniform warmth

Exclusive Equitemp Air Diffuser extends approximately one inch below heater casing – permits mounting above craneways. Unique design produces temperatures at breathing level that vary less than one degree.

ADJUST THE HEAT TO THE JOB!



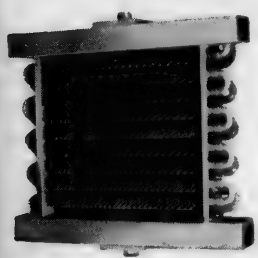
Low ceilings

Indirect heating

To eliminate blasts of air at low mounting heights, simply adjust the vanes on the Equitemp Diffuser. This creates a cone of heated air that mixes with room air; gives even temperatures.

to-wall heating

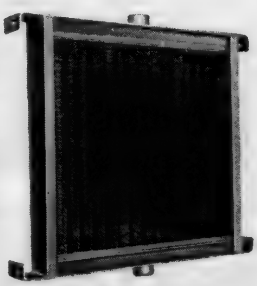
Serpentine coils for hot water



Serpentine coils – specially designed for hot-water systems—have seamless copper tubes for protection against erosion and corrosion. All coils are free-floating to allow for expansion.

One- or two-row steam coils

Horizontal heaters are furnished with either one- or two-row steam coils for high- or low-pressure systems. Special, multi-fin diffusers are available for unusual air-flow applications.



At last—a horizontal heater that's truly quiet...a vertical heater with heat-flow control! Both in a wide range of sizes!

THEY'RE HERE, now! New Venturafin Unit Heaters – quiet operating, efficient, easy to install . . . yet priced with the lowest!

Horizontal models have separate coil systems for either steam or hot water. Extra heating capacity of exclusive serpentine hot-water coils lets you install smaller units in many cases! Heat transfer is efficient, economical – thanks to seamless copper tubing with non-ferrous fins. And louver panels may be adjusted to deflect heat up or down!

Vertical models feature American Blower's adjustable Equitemp Air Diffuser – lets you tailor heat flow to the job! Anemostat or vane-type diffusers also available.

Casings on Venturafin Unit Heaters are ruggedly constructed of heavy-gauge furniture steel, die formed for perfect fit and freedom from rattles; finished in gleaming, easy-to-clean baked enamel.

Visit your American Blower jobber, today! Inspect the new, lower priced Venturafin Unit Heaters; then try them on your next installation!

AMERICAN BLOWER CORPORATION
DETROIT 32, MICHIGAN

CANADIAN SIROCCO COMPANY, LTD.
WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

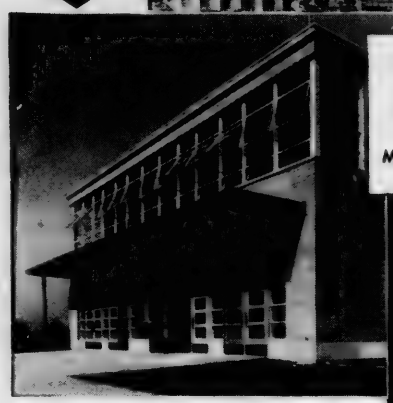
Serving home and industry: **AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS**

5-MILLION DOLLARS IN HIGH SCHOOLS

Gymnasium section, Hinsdale H. S.

HINSDALE TOWNSHIP H. S.
Architects & Engineers
Childs & Smith, Chicago
Heating Contractors
William A. Pope Co., Chicago.

Auditorium section, Maine Township H. S.



MAINE TOWNSHIP H. S.
Architects & Engineers
Childs & Smith, Chicago
Heating Contractors
M. J. Holleran, Inc., Chicago

Famous 600-ft. corridor, Maine Township H. S.

The great combination: Marsh packless — *truly* packless — radiator valve and the trouble-free Marsh thermostatic trap.

The Marsh float and thermostatic trap. There is a Marsh trap for every heating service.

Marsh Valves and Traps all the way through

The answer of three Chicago suburbs to the bumper crop of teen-agers . . . these two college-size high schools. Among America's largest and finest, they cost 5 millions and contain 337,000 sq. ft. of efficiently utilized floor space.

The fabulous, 3-million dollar expansion of Maine Township High will serve the suburbs of Park Ridge and Desplaines. Hinsdale High, a 2-million dollar high school, is for the young folk of famous Hinsdale alone. Who says we are not catching up with schooling needs? That 600 ft. corridor in the Maine Township school sets a standard of architectural design and quality construction never before found in the nation's schools.

For the best in buildings, the best in heating of course . . . and for the radiators and coils, the best in valves and traps. Hundreds of Marsh Packless Radiator Valves, Radiator Traps and F & T Traps went into the well designed heating systems which involve both direct and indirect radiation.

An excellent example, this — but only one of many examples of the respect for Marsh quality demonstrated on a nation-wide scale in the selection of Marsh equipment by foremost architects and contractors. Ask for Catalog 76-H covering the full line of Marsh Heating Specialties.

MARSH HEATING EQUIPMENT CO., *Sales Affiliate of Jas. P. Marsh Corporation* **Dept. U, Skokie, Illinois**

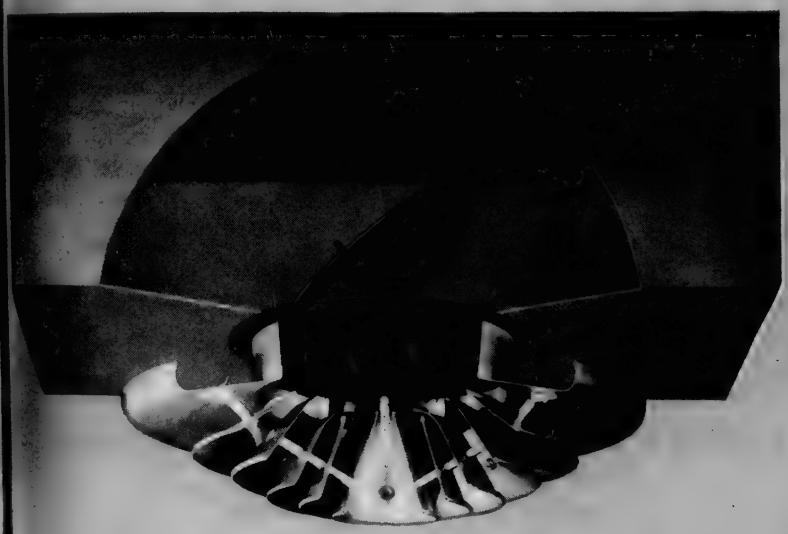
MARSH Heating Specialties

Here's a <u>new</u> way to cut costs and save time on

duct take-off installations!

ANEMOSTAT® COMBO-UNIT COMBINES

{ VOLUME CONTROL
ANGLE RING
EQUALIZING DEFLECTOR



Anemostat's NEW Combo-Unit is a combination volume control, angle ring and equalizing deflector. ***This prepackaged unit cuts installation costs in half.*** Extra rings, screws and odd parts are not required. Installation time is reduced to a minimum, and it's a cinch to install. ● Use Anemostat Combo-Units on your next job.

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

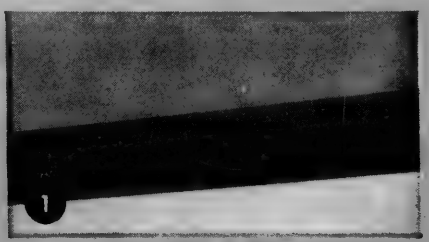
ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

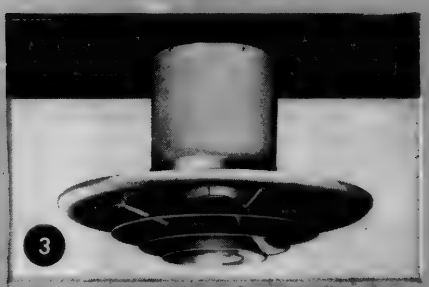
"No Air Conditioning System Is Better Than Its Air Distribution"

Easy, Quick Installation



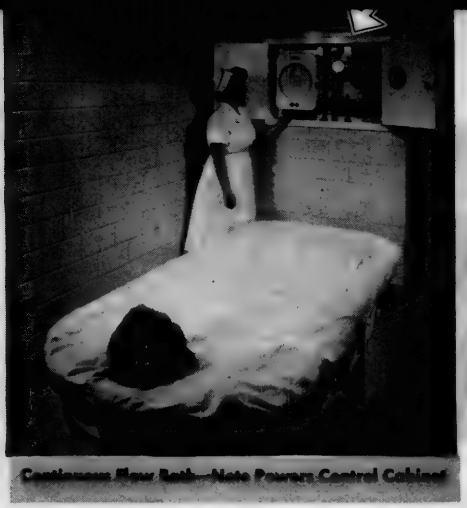
Cut Hole in Duct

Fasten Combo-Unit

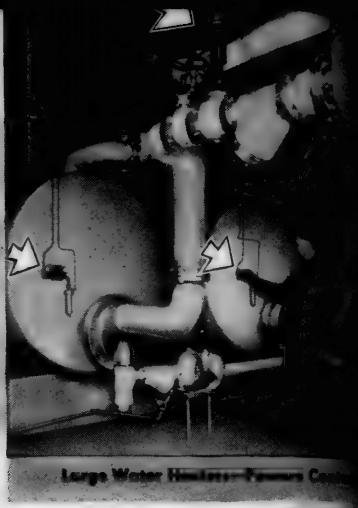


Fasten Take-Off and Air Diffuser or

Fasten Air Diffuser to the Combo



Continuous Flow Bath—Note Powers Control Cabinet



HINSDALE, ILL. SANITARIUM AN
SHOWS DIVERSITY OF POWER

★ FOR HEATING ★ AIR CONDITIONING ★ WATER HEATERS ★ HYDRO-THERAPY ★ SHOWER

Few 200 bed institutions are as well equipped to save and prolong lives as Hinsdale's Sanitarium and Hospital

It's six operating rooms, X-Ray department (including a 250,000 volt deep-therapy machine for cancer treatment), delivery rooms, beautiful nursery and obstetrical department are all equipped with the best modern equipment.

Outstanding Polio Treatment Center. Facilities here can accommodate up to 30 polio patients and keep them in complete isolation.

Three iron lungs, rocking beds, steam rooms and many types of hydro-therapeutic baths under the care of skilled attendants provide patients with the best service obtainable.

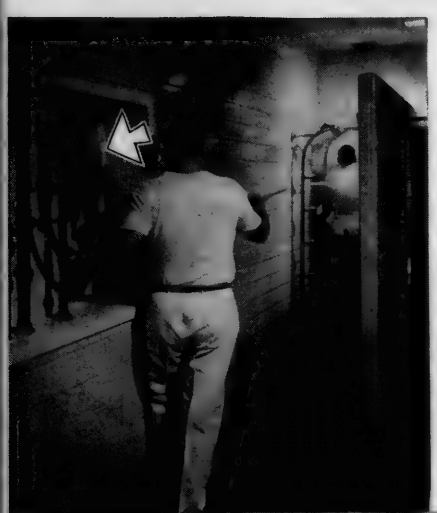
Comfort and Safety of Patients here is assured by the dependability of Powers thermostatic controls used throughout the building.

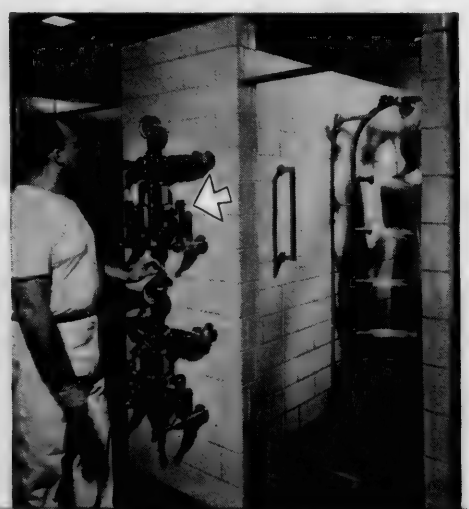
When you want help in selecting the right type of control for hospitals or any other type of building, call in an experienced Powers engineer. There's no obligation. (b8)

THE POWERS REGULATOR COMPANY

SKOKIE, ILL. • Offices in Over 50 Cities in U. S. A., Canada and Mexico

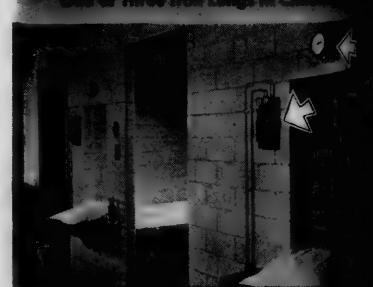
OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL





Needle Spray and Hydrotherapeutic Showers are Both Powers Controlled

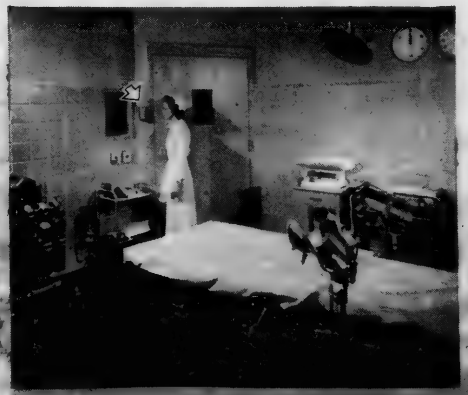
One of Three Iron Lungs in Children's



Steam Rooms Regulated by Powers

Architects and Engineers: **Fugard, Burt, Wilkinson and Orth** • **Edward G. Halstead**
General Contractor: **E. H. Marhoefer Jr. Co.**
Contractors: **Thomas J. Douglass & Co.** (Heating) • **Charles E. Gazin** (Plumbing)
Plumbing Wholesaler: **American Radiator Standard Sanitary Co.**
All of Chicago, Ill.

Therapy X-Ray Room



Air-Conditioned Delivery Room

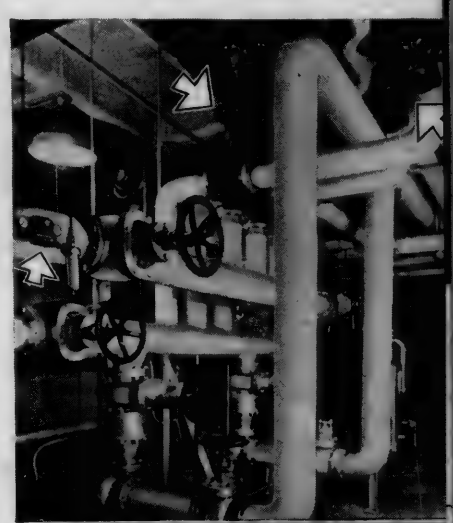
Powers Control on Sitz Bath with Raised Seat

SPITAL

APERATURE CONTROL

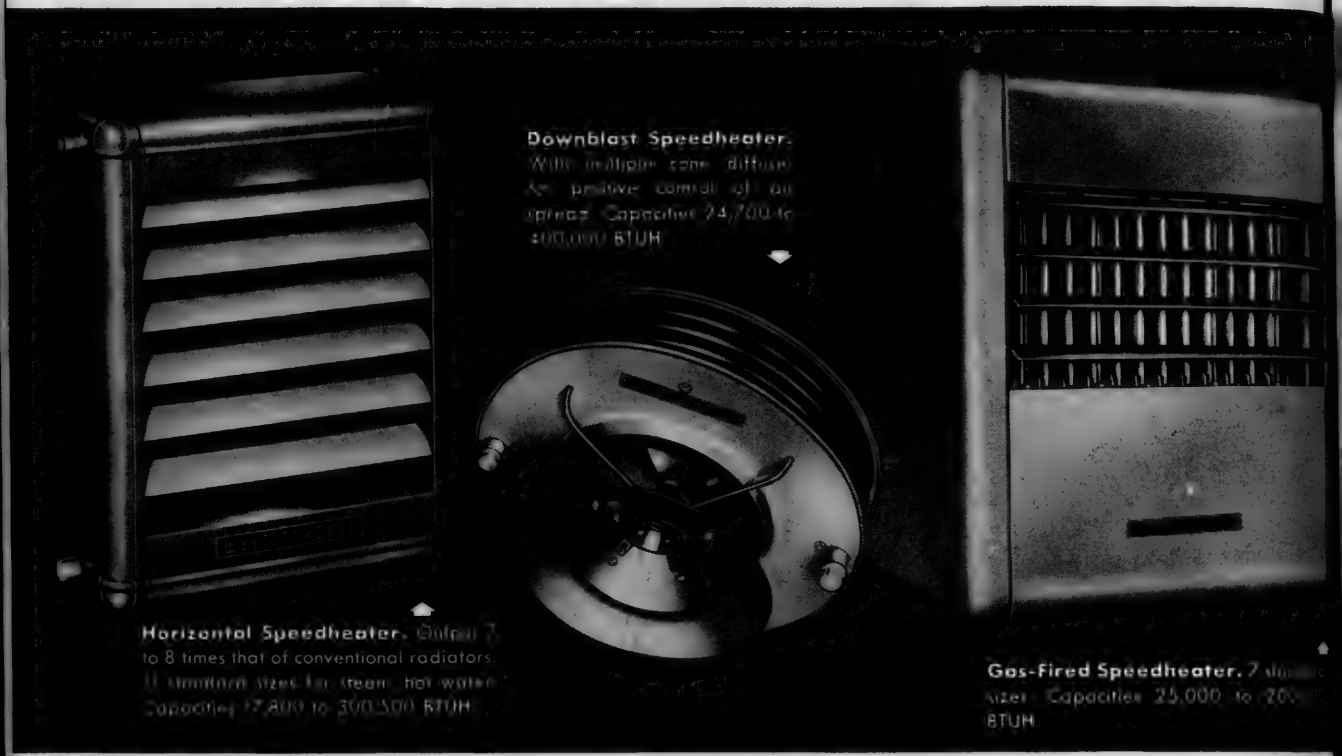
Section of Nursery

Powers Controlled Whirlpool Bath for Polio Patients



FLOW HEAT EVENLY OVER LARGE AREAS . . .

Westinghouse Speedheaters



Outstanding features assure quiet, reliable operation . . . easy installation:

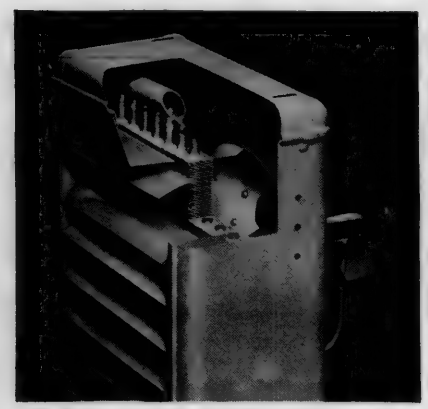
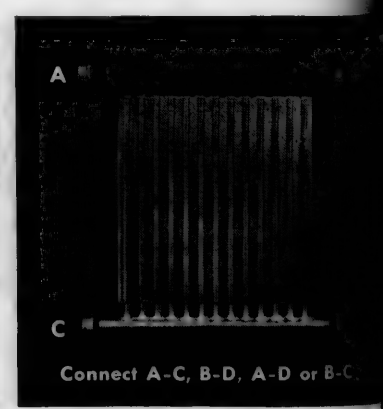


Plate fins cut noise, maintain uniform air flow, minimize clogging of coil with dirt and dust. Adjustable louvers spot or spread heat directly into work zone. Unit requires no warm-up—a flip of a switch generates *instant heat.*

Pliable steel hangers, a Westinghouse exclusive, simplify installation of Horizontal Speedheaters. Heavy-gauge welded steel casings, heavy seamless copper tubes, rugged motor and fan increase service life.



Four connection combinations further simplify installation of Westinghouse Horizontal Speedheaters . . . reduce piping costs . . . allow flexibility in installation to fit varied unit and piping locations.

Spread Instant Heat on Work Zones

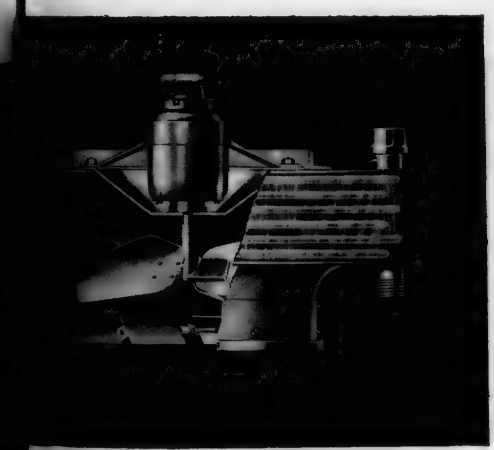
Modern-design Speedheaters slash fuel costs up to 25% when used as complete systems or supplements to existing central systems.

These three Westinghouse Speedheaters provide instant, low-cost heat—*where* and *when* you want it—for applications ranging from spotting heat into small areas, to spreading heat comfortably and efficiently over large work zones. Both dependable and attractive, they are ideal for stores, offices, factories, warehouses—anyplace, in fact, requiring quick, uniform heat at lowest cost.

Westinghouse Speedheaters go to work immediately. Their *instant heat* eliminates fuel loss . . . saves, as proved in installations across the country, up to 25 per cent in fuel costs over old-style heating systems. Available in sizes from 17,800 to 400,000 BTUH, these Speedheaters supplement your present central system for most effective heat coverage . . . or satisfy, through flexible unit selection and placement, your entire heating needs.

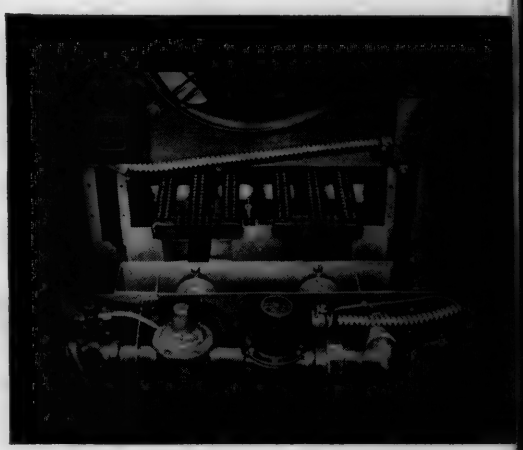
Check on these versatile units today. Call the Westinghouse-Sturtevant representative conveniently located in your area, or write Westinghouse Electric Corporation, Sturtevant Division, Boston 36, Mass.

For specifications, dimensions, performance data, send today for CATALOGS 1521 (Steam—Hot Water) and 1525 (Gas-Fired)



For buildings with high ceilings, Westinghouse Downblast Speedheaters are ideal. Powerful fans and directional vanes project heated air down to work levels, blanketing large areas with effective, economical heat even where equipment and partitions obstruct circulation.

Fully automatic Gas-Fired Speedheaters eliminate need for central heating plants . . . run on low-cost natural, manufactured or LP gas. Units have seal of approval of AGA Testing Laboratories.



WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S Westinghouse

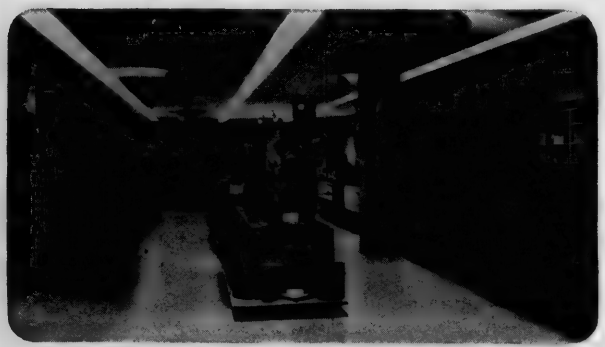
Fountain in the garden of the Student Union.

New Student Union Selects Air Conditioning & Refrigeration

This fine building of the Indiana University Medical Center, at Indianapolis, comprises apartments, guest rooms, dining halls, shops, swimming pools, etc.

Here both air conditioning and food service loads are handled by 13 Frick refrigerating machines, and a Frick unit air conditioner. Seven fractional-horsepower units serve food-dispensing equipment, while four of 7½ horsepower each cool a dozen walk-in boxes. The Frick "ECLIPSE" machines operate a chilled-water air conditioning system. Installation by Hayes Bros., Inc., Distributors at Indianapolis and South Bend.

For that important cooling job of yours, specify Frick equipment: there's nothing to compare with it. Write now for Bulletin 100 on "ECLIPSE" compressors.



The book store, cafeteria, and other public spaces are all air conditioned.

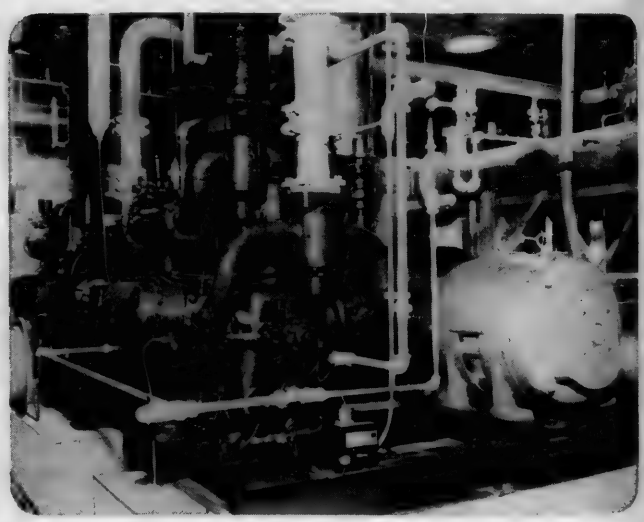
Below: Some of the 11 Frick low-pressure units used for food service at the Student Union.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery



Two Frick "ECLIPSE" compressors, each with nine cylinders, handle the air conditioning of public spaces in the Student Union at Indianapolis.

THRUSH QUALITY

pays dividends in time savings and customer satisfaction

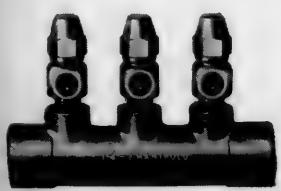
Balancing Valves *for Radiant Hot Water Heat*

GIVE ACCURATE CONTROL OF WATER FLOW, POSITIVE SHUT-OFF FOR AIR ELIMINATION

SAVE TIME and trouble in balancing radiant coils with these precision built Thrush Balancing Valves. Carefully made to give accurate control of flow. In eliminating air, the shut-off is positive. Flared fittings for $\frac{3}{8}$" and $\frac{1}{2}$" tubing. See your wholesaler or mail the coupon below today.

THRUSH MANIFOLDS

Thrush Manifolds save time, space and fittings. 1" and 1¼" sizes, each with two, three or four ⅜" or ½" threaded branch outlets.



Return Manifold with Balancing Valves

Supply Manifold

Mail Coupon Today !

H. A. THRUSH & COMPANY, Department D-7, Peru, Indiana

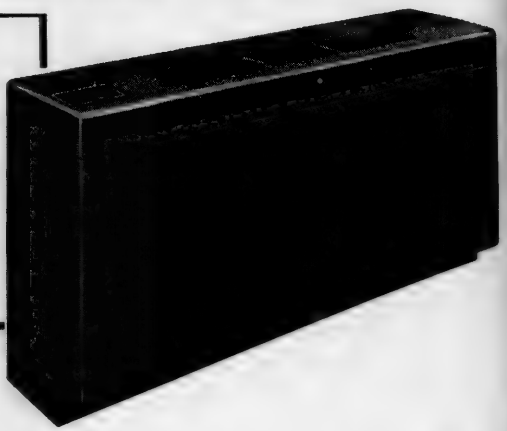
Please send us illustrated bulletin on Thrush Balancing Valves and Manifolds.

NAME _____ ADDRESS _____

CITY _____ STATE _____

Simple, efficient, easy to install...

The REMOTAIRE
by
AMERICAN-Standard



- **Year 'round heating and cooling**
- **Central plant, multi-room installation**
- **Individual room temperature control**
- **Filters and circulates the air**
- **Single piping circuit**

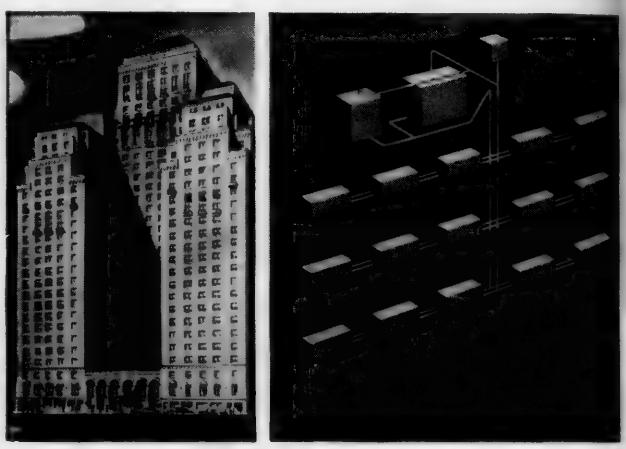
■ Remotaire installations are simple and direct. The same piping circuit carries chilled water for summer cooling, hot water for winter heating. There is no bulky ductwork. Water is conditioned in a central plant, yet temperatures can be controlled individually in each room where a unit has been installed.

Remotaire units have reversible coils for right or left hand connections. And each part of the unit is easy to get at.

To meet all types of installation requirements Remotaire units are available in 200, 400, and 600 cfm capacities.

Your customers will like the Remotaire. Heating and cooling performance is outstanding. The installation looks good, too. Units come in handsome semi-gloss Cooltan jackets but can be painted to match the room interior if desired. Remotaire units can be installed free standing, partially recessed, or totally recessed.

Contact your local American-Standard sales office or your wholesale distributor for more information about Remotaire performance and installation, or write for literature—Form 417.

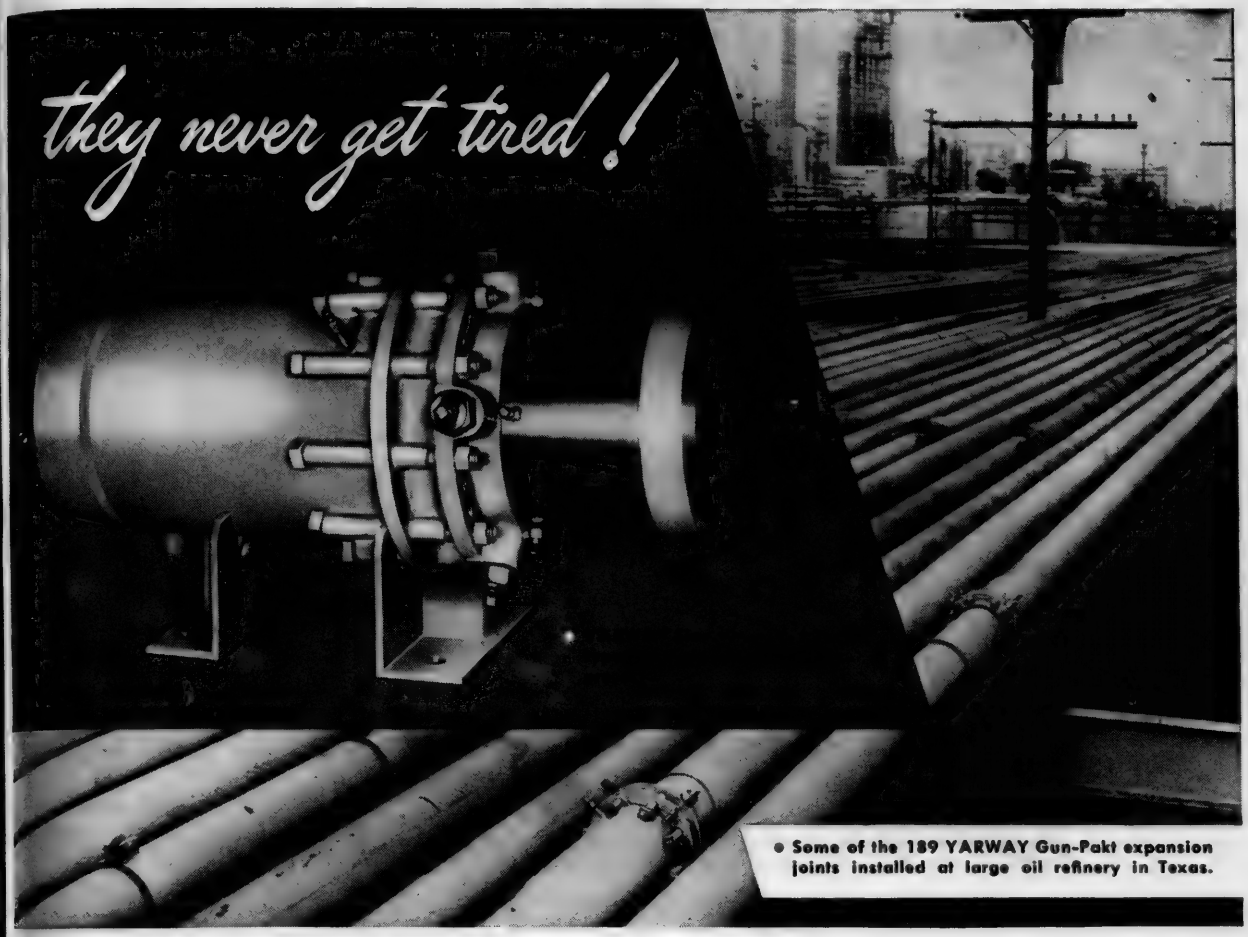


THE REMOTAIRE IS VERSATILE. An example of a Modernization System is the Park Sheraton Hotel of New York. The above rendering shows how simple the Remotaire piping is. Picture below illustrates our attractive Remotaire unit in a Park Sheraton Hotel room.

AMERICAN-Standard
WATER HEATING-COOLING SYSTEMS

American Radiator & Standard Sanitary Corporation, Dept. HV-74, Pittsburgh 30, Pa.

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



• Some of the 189 YARWAY Gun-Pakt expansion joints installed at large oil refinery in Texas.

No fatigue with 189 YARWAY GUN-PAKT EXPANSION JOINTS at this large Texas refinery

THEY just work and work for years and never get tired. Yarway Gun-Pakt slip-type joints simply will not fail through fatigue. They will operate smoothly, as frequently as required, over long, full traverse up to 12" single type or 24" double type or short, partial traverse, day in and day out—with never any danger of metal fatigue or failure.

This is just one of the many big advantages found in Yarway Gun-Pakt expansion joints. Other outstanding Gun-Pakt features are:

1. Can be serviced under *full* steam pressure day and night, thus avoiding costly and inconvenient shutdowns.
2. Fixed Gun-Pakt gland serves as "built in" external guide and permits less costly and rigid pipe guidance than required by many other types of joints.
3. Lower pressure load on end anchors because excessive strains are eliminated.

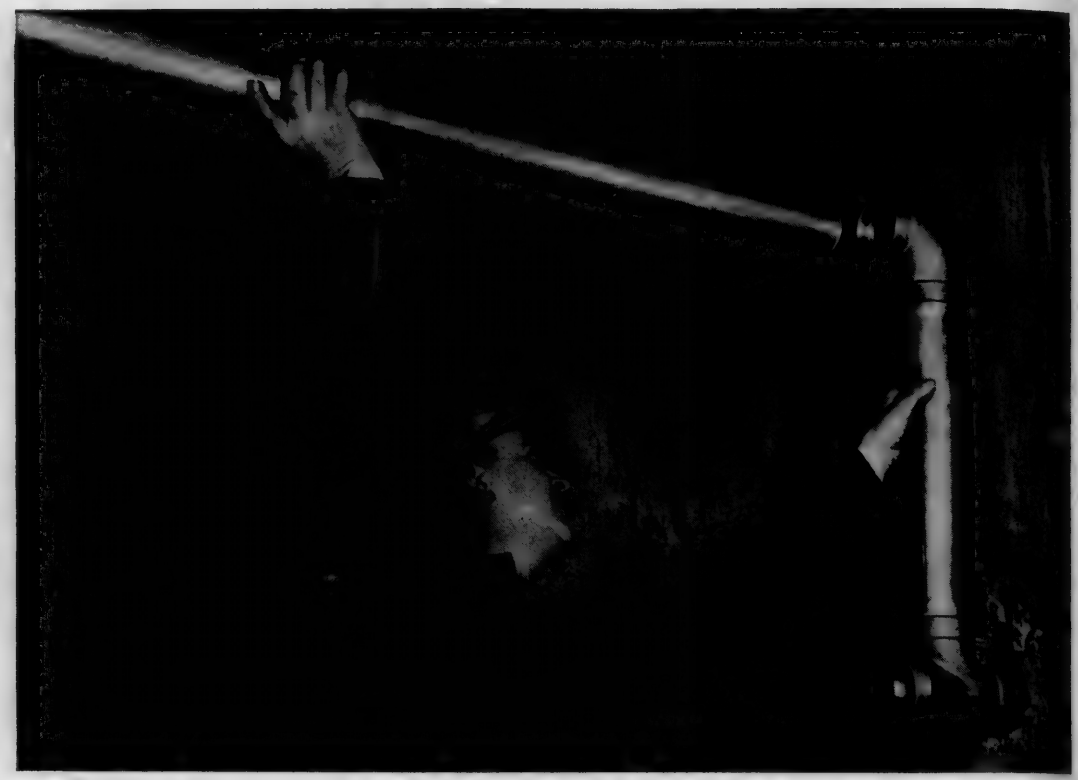
Used for many years with success in well-known refineries, industrial plants, utilities and institutions. When replacing present joints or planning new steam lines, it will pay you to look into the advantages of the Yarway Gun-Pakt expansion joint. Write for Yarway Bulletin EJ-1913.

YARNALL-WARING COMPANY
104 Mermaid Avenue, Phila. 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY®

gun-pakt expansion joints

When you count all the costs...



You can't beat COPPER for drainage lines

CHASE COPPER WATER TUBE is *economical* for soil, waste and vent lines when you count the *installed cost* and add the customer satisfaction it brings. With Chase Copper Tube you can do a better job *in only a fraction of the time that other materials require.* Chase Tube comes in long 20 foot lengths... pre-cutting and pre-assembling is practical. Next time you figure a job, count *all* the costs of installing Chase Copper Water Tube... then call your Chase Plumbing Wholesaler.

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

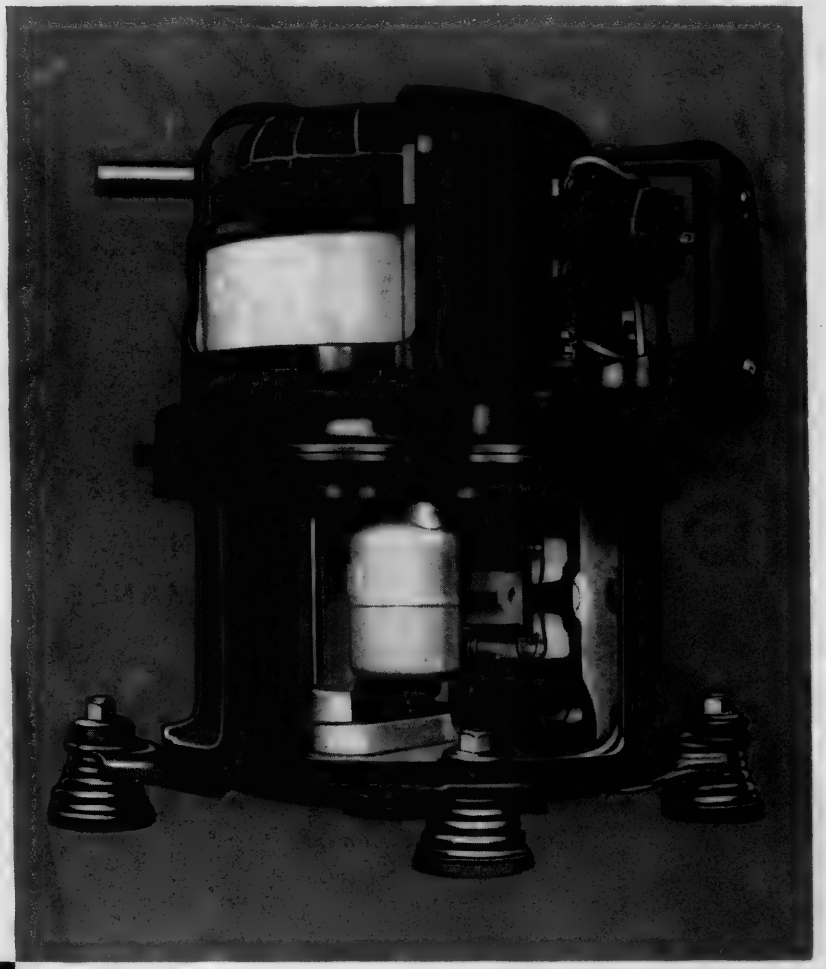
Write for full information on new Chase movie "Down the Drain." It is loaned free to trade groups and associations.

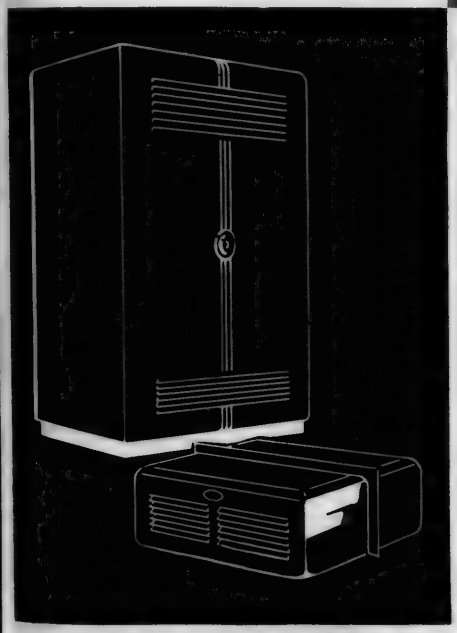
The Nation's Headquarters for Brass & Copper

Albany†	Chicago	Denver†	Kansas City, Mo.	Newark	Pittsburgh	San Francisco
Atlanta	Cincinnati	Detroit	Los Angeles	New Orleans	Providence	Seattle
Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(†sales offices only)

COPELAND WELDED HERMETICS

bring cool-running, 2-cylinder smoothness to package air conditioning



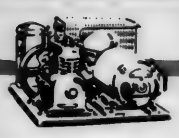


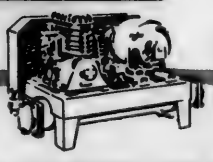
You're looking at a cutaway view of the welded motor-compressor that can give your refrigeration and air conditioning products the competitive edge you need.

This potent Copeland package is engineering at its best. Twin cylinders bring whisper-quiet smoothness. Heavy-duty, high power factor motor insures positive performance and long-range economy. Use of F-12 in these motor-compressors can result in as much as 75 F. lower temperatures in windings, crankcase, oil and discharge side. You'll appreciate their high capacities.

We could go on, point by point, and prove construction superiority. Better yet, we want you to test the Copeland welded motor-compressor in your own equipment under your own conditions.

Write, wire or phone for details about the "try it yourself" test.





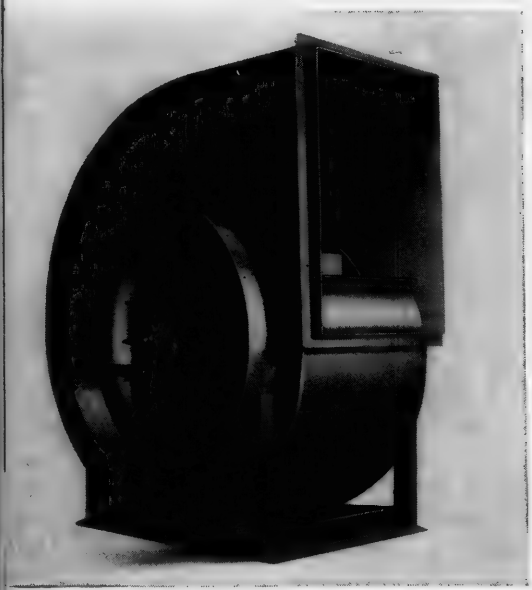
Copeland
DEPENDABLE Electric REFRIGERATION

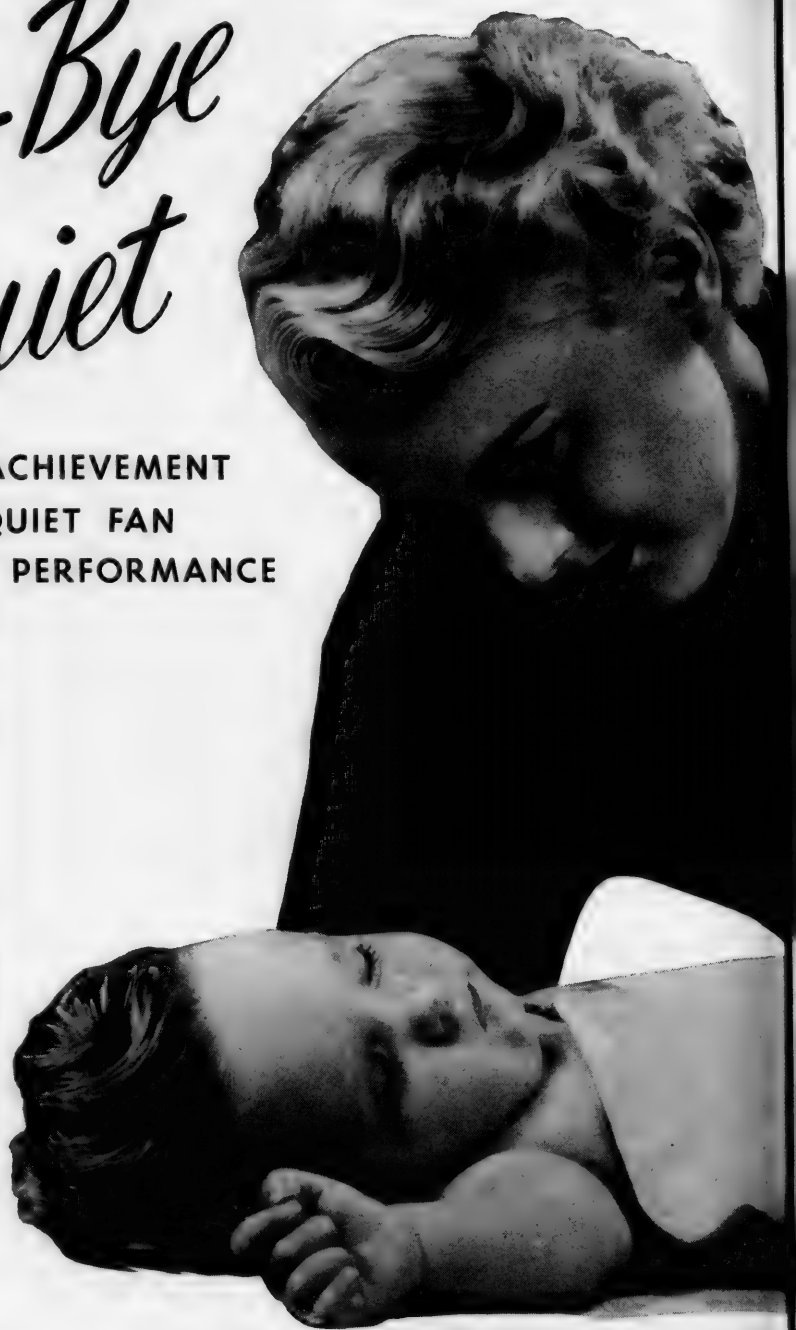
REFRIGERATION UNITS (OPEN-TYPE AND COPELAMETIC) WATER COOLERS

COPELAND REFRIGERATION CORPORATION SIDNEY, OHIO

"Hush-a-Bye Quiet"

A NEW ACHIEVEMENT IN QUIET FAN PERFORMANCE





The new "Buffalo" Type "BL" Limit-Load Fan with the "Q" Factor* brings in a new era of low-decibel performance which will have a profound effect on ventilation in plants, hospitals, hotels, office buildings, schools, stores and auditoriums . . . in fact, in any building where "quiet" is important. Streamlined air movement through "Buffalo's" fixed inlet vanes and new backward curved blade wheel results in high efficiency, superb smoothness and quietness. Why not see the reasons for this, in new Bulletin F-100. Your copy mailed on request.

** The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

480 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

it eats up waste!

Food waste and waste motion . . . a modern kitchen disposer eliminates both quickly, permanently.

Today's homemaker never leaves her kitchen sink as she takes care of what used to be an unpleasant chore. *In Many of America's best-known food waste disposers an Emerson-Electric motor does this work for her.*

Emerson-Electric specializes in building motors for products that eliminate waste motion, that perform efficiently for the home, on the farm, in business and industry. It has done so for 64 years, and offers standard motors in ratings from 1/20 to 5 h.p., and hermetic motors 1/8 to 20 h.p. Your inquiry is invited.

THE EMERSON ELECTRIC MFG. CO.
St. Louis 21, Mo.

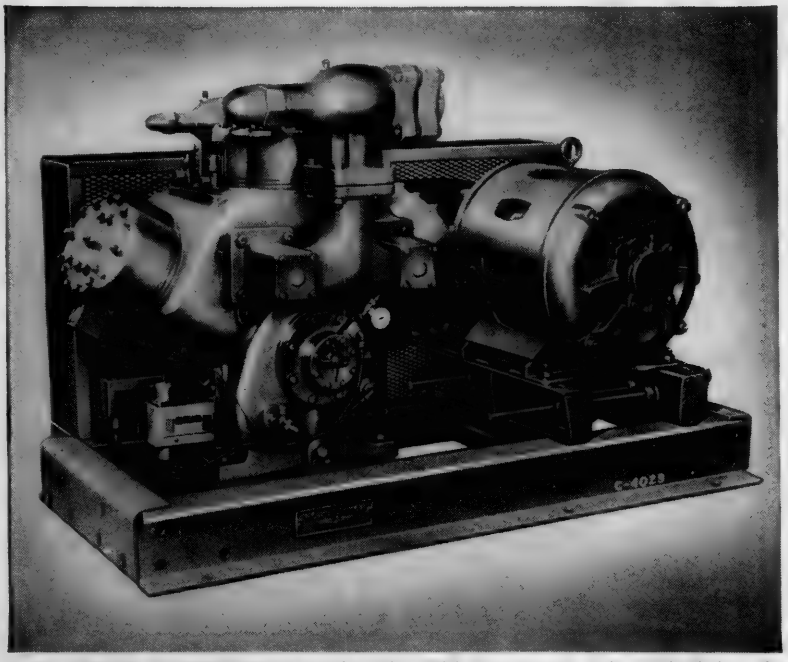
Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M411-A Capacitor-Start
- ☐ M411-B Split-Phase
- ☐ M411-C Integral
- ☐ M411-D Fan-Duty
- ☐ M411-E Oil-Burner
- ☐ M411-F Jet Pump
- ☐ M411-G Blower

EMERSON ELECTRIC
MOTORS • FANS — APPLIANCES

The whole industry's talking about Worthington's new Freon compressor



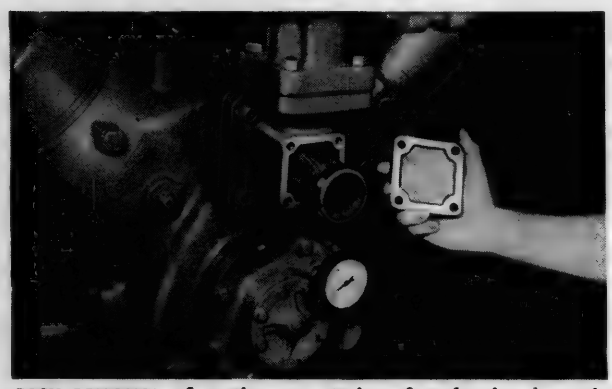
TRIM, STURDY CONSTRUCTION marks this 4JF6 compressor unit — 50-60 hp, six cylinder W-type compressor. The complete compact unit consists of fabricated steel base, compressor with valves, gauges and safety controls, drive and safety guard. Designed to operate in conjunction with Worthington evaporative condensers in localities where city water is scarce or high in cost. Also available with shell and tube condenser. Complete range from 3-150 hp.

"The high capacity unit we've been waiting for!"

"Greater operating efficiency!"

"There's nothing else like it!"

And every comment you hear is true! The refrigeration compressor is the most vital element of any air conditioning or refrigeration system. That's why Worthington spent years in developing the new "J" Freon compressor. That's why Worthington invested over a million dollars in compressor research. *And that's why you can't find its match in any other unit.* Only a few features of the new "J" Freon compressor are highlighted here — get the full story by contacting your nearest Worthington district office or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.33, Harrison, New Jersey.



EASY REMOVAL of suction gas strainer for cleaning is made possible by new suction manifold design. No pipes, valves or other parts need to be dismantled in order to get at the strainer. And Worthington's new electric unloaders automatically balance power consumption with load requirements.

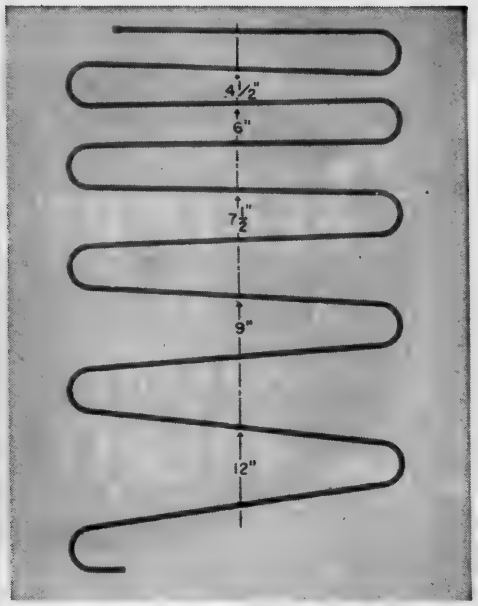
LORD & TAYLOR'S new West Hartford, Conn., store depends on Worthington to provide comfortable air conditioning for its customers. Two 150 hp "J" compressors and two evaporative condensers make up the highly efficient Worthington air conditioning team at this modern store.

A.4.33

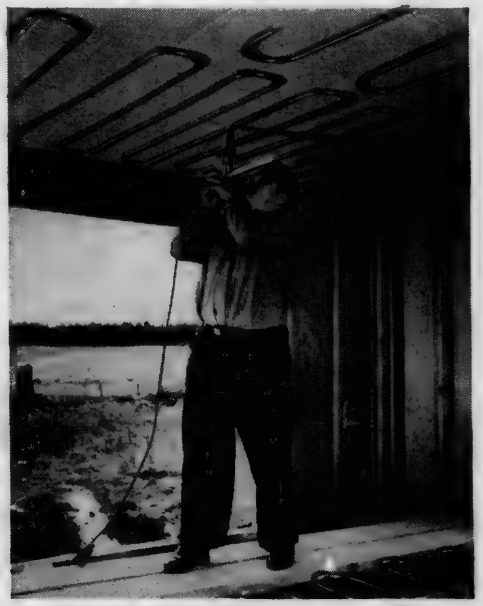
WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

PG's are lightweight and easy to handle. They come packed in cartons, ready to install.



Center-to-Center spacing is readily adjusted to design requirements.



PG's are straight and true—no sags or dips—make plastering easier.

Use PG's on your next radiant heating job

Now radiant panel heating systems are more practical than ever... in rust-free copper tube. PG's** (Panel Grids)—a new development by The American Brass Company—are the reason why.

PG's are the *only* standard-size radiant panel heating grids that are *factory formed*... ready to install. Shipped in a figure-8 bundle, they open readily to a flat sinuous coil pattern. They do away with slow, tiresome on-the-job bending and awkward "stringing up" of coiled tubing.

⅛" PG's contain 50 feet of ⅜" nominal (½" O.D. actual) Type L ANACONDA Copper Tube and come *preformed* to common 6" c-c spacing. You can contract or extend them easily by hand to meet all desired spacing requirements within a range of 4½" to 12" c-c.

½" PG's consist of 50 feet of ½" nominal (⅝" O.D. actual) Type L tube formed to a 9" c-c spacing and are also easily hand-adjustable to all c-c spacing from 6" to 18".

Try PG's on your next job! See for yourself how they make installation easier, faster—and better. For more information about this revolutionary new development in panel piping, write for Publication C-6. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

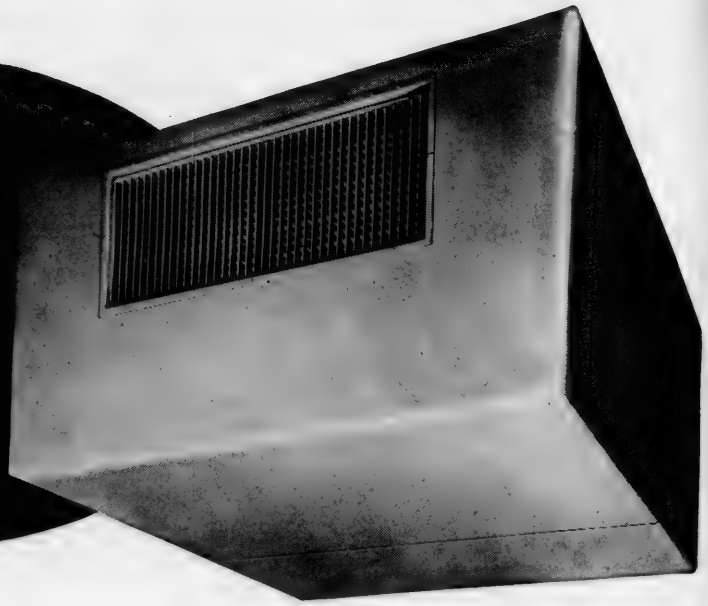
*Patent Applied For

5409

ANACONDA®

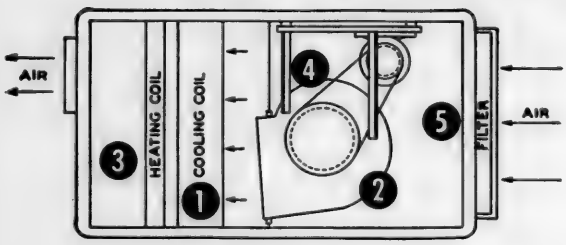
Copper Tube PRE-FORMED Panel Grids for Radiant Panel Heating

NEW FEATURES of PROVEN MERIT



KRAMER

AIR CONDITIONING UNITS



(1) MUGGY-AIR-CONTROL

It "squeezes" extra moisture from the air on muggy days without reheating, dampers or excessive cooling. No short cycling and uncomfortable conditions.

(2) "BLOW-THROUGH" DESIGN

Fan-motor assembly always exposed to normal room temperatures. A unique design with many advantages, resulting in —

No motor overload and no loss of bearing lubricant from hot air of the heating coils.

No corrosion of fan-scroll assembly from moisture carry-over of the cooling coils.

(3) ANTI-SWEAT CONSTRUCTION

Only a small portion of the casing is exposed to cooled air; that section is heavily insulated.

Access doors and grille have scientific anti-sweat designs.

(4) QUIET OPERATION

The fans and motor form an integrated assembly independently rubber-mounted to the casing. All moving parts are completely isolated by rubber.

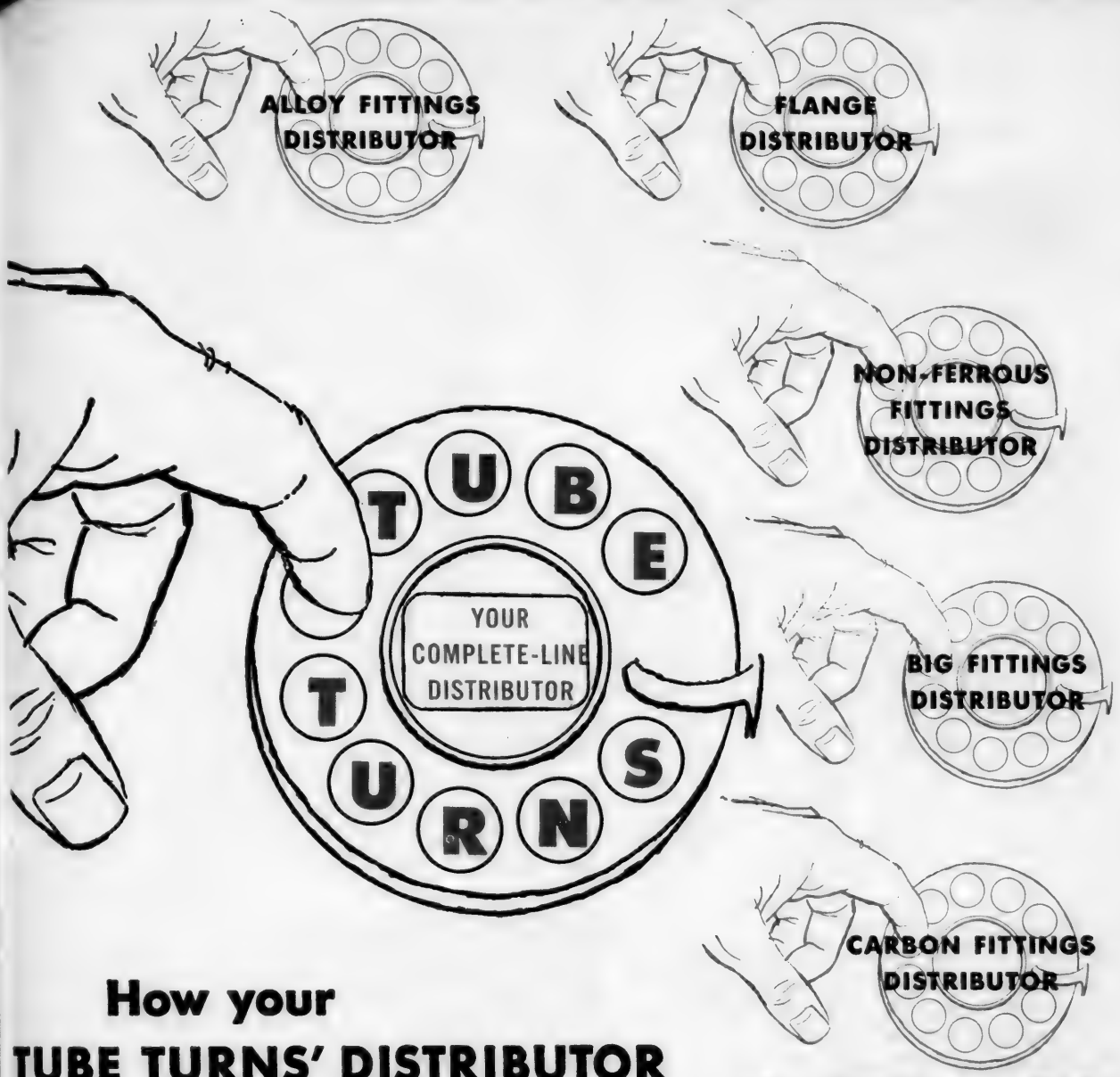
(5) FOR FINISHED INTERIORS

Graceful lines with no unsightly belts, motor and guards exposed to view. Finished in hammer gray enamel.

MANY OTHER OUTSTANDING FEATURES

WRITE FOR BULLETIN AC-238

KRAMER TRENTON CO. • Trenton 5, N.J.



How your TUBE TURNS' DISTRIBUTOR saves you time and money

ONE CALL . . . ONE ORDER is all it takes to fill *all* your needs in welding fittings and flanges when you buy from your Tube Turns' Distributor. He provides industry's broadest line—over 4000 top quality items—different types, sizes, schedules and materials. He saves your purchasing time, cuts your red tape, acts as your warehouse and gives you prompt delivery and money-saving assistance on piping problems... backed by Tube Turns' world-famous engineers.

Are you taking advantage of this cost-cutting service?

"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Chicago • Denver • Los Angeles
San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

where flooding sunlight sets new tasks for piping

LEVER HOUSE

shades operating costs with JENKINS VALVES

Architects: SKIDMORE, OWINGS AND MERRILL
Mechanical Engineers: JAROS, BAUM AND BOLLES
General Contractors: GEORGE A. FULLER CO.
Heating and Air Conditioning Contractors: KERBY SAUNDERS, INC.
Plumbing Contractor: GILLMAN-ROUS-PESCE CORP.

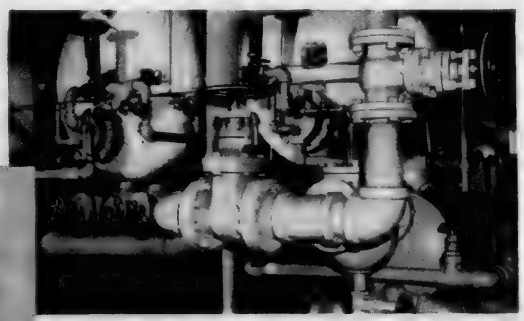
Where such extensive use of glass permits direct penetration of sun heat along with sunlight, interior comfort is largely dependent upon efficient, year-round air conditioning. At Lever House, for example, a high velocity duct system, served by two steam turbine centrifugal compressors, supplies 700 tons of refrigeration for three separate air-conditioning zones. Individual window units cool or heat the periphery of each floor as required. Air from such areas re-enters the ducts, is blended and discharged through centrally located ceiling diffusers, keeping temperatures in balance over the entire floor.

The serious consequences of failures and interruption of such facilities required careful selection of all components on the basis of proved dependability, safety, and long-range maintenance economy. Jenkins Valves were chosen after thorough study of performance records in all types of service.

Jenkins Valves are being specified for more and more of the news-making structures that are pacing the advance in architectural design. It is a repeated expression of confidence in their *extra measure* of efficiency and economy.

Despite this extra value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17.

A slim, gracefully proportioned tower of green-tinted glass and polished stainless steel, Lever House provides efficient, comfortable working quarters for more than 1200 employees of the world-famed Lever Brothers Company and its three divisions. It has won wide acclaim as a major contribution to progress in the design of modern commercial structures.



Among nearly 3000 Jenkins Valves, controlling all lines, are these Iron Body Gate Valves on steam condensate lines of hot water system.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

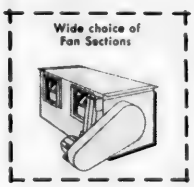
NOW! PERFECT WEATHER

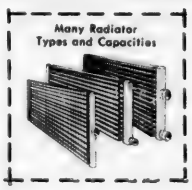
. . . at your finger tips!

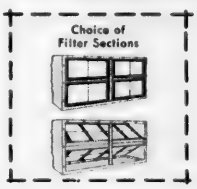
when you plan with . . .

HERMAN NELSON HEATING AND VENTILATING UNITS

Custom-Assembled from standard components







NEW!

Write for Catalog No. 775

Custom-assembled from standard components, Herman Nelson Heating and Ventilating Units give you all the flexibility of specially designed systems at prices no higher than ordinary "fixed" units with similar capacities. Choose from seven different radiators – three distinct filter types – a wide range of motor sizes and fan combinations; further choices, too, in unit bases, wall intakes, damper sections, humidity control.

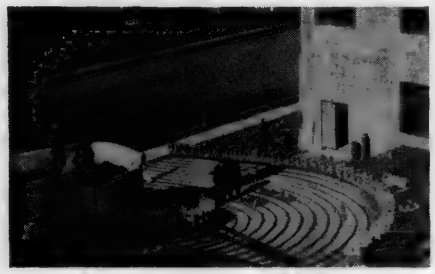
Let us show you how a Herman Nelson Heating and Ventilating Unit can fit into your specifications, do the job you want done, and do it with the greatest economy.

AAF herman nelson

American Air Filter COMPANY, INC. | **294 Central Avenue Louisville 8, Kentucky**

No more shipping ~~slowdowns~~ snow slowdowns!

Trucks and trailers will never get stuck in this dock approach.



All-weather access assured by snow melting at warehouse ramp.

Snow will never block the truck approach to this mill.

Snow Melting helps industry move what it makes!

Transportation slowdowns, caused by snow or ice at loading and receiving docks, in road or driveway approaches, on private tracks and spurs, are costly penalties to pay when modern snow melting systems are available.

The constant, uninterrupted flow of both raw materials and finished products *in* and *out* of plants, warehouses and other business buildings is as vital to the nation's commerce as production and manufacturing itself!

So, where hazardous weather may be expected even occasionally, steel pipe snow melting systems provide practical insurance . . . while in areas where snow and ice may be every-winter plagues, snow melting stops delay at the approaches dead-in-its-tracks!

You would expect, and rightly so, that steel pipe is the favored heat transmission medium for these industrial and commercial snow melting installations. For steel pipe has been the faithful stand-by of industry for more than 60 years . . . for plumbing, heating, fire sprinkler systems, power, steam and air transmission, and a host of mechanical uses. Once again industry turns to this economical and durable product for the panels, coils and runs of its snow melting installations.

Yes, for snow melting, *steel pipe is first choice,* the most widely used pipe in the world!

Steel Pipe is First Choice

Send for new, free 32 page color booklet "Steel Pipe Snow Melting and Ice Removal Systems".

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N.Y.

MARLEY covers the Water Cooling front...

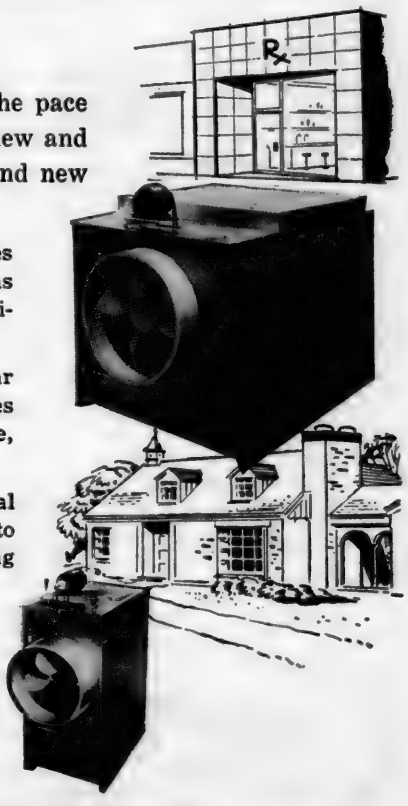
with the only complete line of cooling towers that offers an efficient, economical unit for every possible installation

It's a line that is never static. All the advancements that set the pace for the industry originate right here. Every year Marley presents new and improved towers that bring higher performance, added capacity and new economy. Here's the program for 1954:

NEW CS (COUNTERFLOW STEEL) SERIES . . . for 250 tons capacities and upwards. Here is a completely new design tower for metropolitan areas with rigid fire codes. It is ultra-flexible for location and engineered to eliminate expensive hoisting and erection costs.

MODEL 12 DOUBLE-FLOW AQUATOWER . . . adapts the most popular intermediate capacity cooling tower to larger capacity services. It enhances all the desirable features of this tower . . . high performance low silhouette, excellent weight distribution and simple piping.

MARLEY AQUATOWERS . . . another size has been added to this original line of "packaged" units. All models have been improved to bring to the 2 to 60 ton range even better performance and greater installation and operating economies.



For complete information on these new and improved Marley cooling towers, get in touch with your local Marley man today.

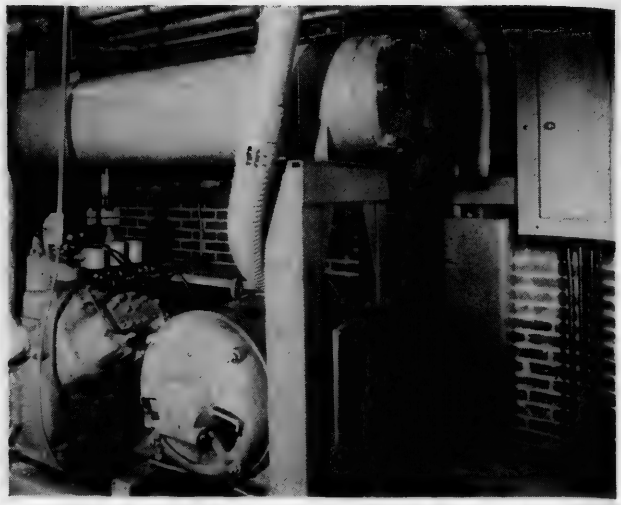
MARLEY

The Marley Company Kansas City, Mo.

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

Start Squirrel-Cage Motors THE MODERN WAY

This 100 hp 3 step increment start motor, with double extended shaft, drives two refrigeration compressors in an Atlanta hospital.



A 40 hp open type high torque motor with an increment starter, drives this compressor in a Houston office building.

with the Wagner Increment Motor and Starter Combination

You benefit when you install a Wagner Increment Motor and Starter "package" because you get a most economical, highly efficient motor and starter combination that limits inrush of motor current to values that are acceptable for the distribution systems of most power companies.

Wagner two-step starter combinations are suitable for most applications. A three-step increment starter is available for applications calling for unusually low inrush of starting current.

Your nearby Wagner engineer will be glad to help you select the combination that meets *your* requirements. Call the nearest of our 32 branch offices, or write us.

Magnetic part-winding increment starter.

Type CP Motor, 1 to 250 hp.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6463 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

M54-14

Maid with Dorex Air Recovery

SHE'S the maid who made Springs Mills sheets famous... now working happily in The Springs Cotton Mills' offices at Fort Mill, South Carolina, where Dorex Air Recovery is part of the air conditioning system.

In this newest of several applications for Springs, Dorex converts about 10,000 c.f.m. of used, recirculated air into FRESH AIR. Thus, Air Recovery permits a substantial reduction of outside air requirements for ventilation. So less conditioning and ventilating equipment is needed initially; operating costs are less over the years.

Wherever installed, Dorex Air Recovery saves money. Records of over twenty years' experience and 10,000 installations show that every $100 invested in Dorex Air Recovery should save some $400 on initial equipment. And every $1 spent for Dorex maintenance should return a $4 saving in operating costs.

Let us help you build business with Dorex Air Recovery. Just clip the coupon to your letterhead and mail it today. Connor Engineering Corporation, Danbury, Connecticut.

CONNOR
ENGINEERING
CORPORATION

dorex®
air recovery

CONNOR ENGINEERING CORP.
Dept. B-74, Danbury, Connecticut

Please send me, without obligation, complete information on Dorex Air Recovery.

Name_____

Position_____

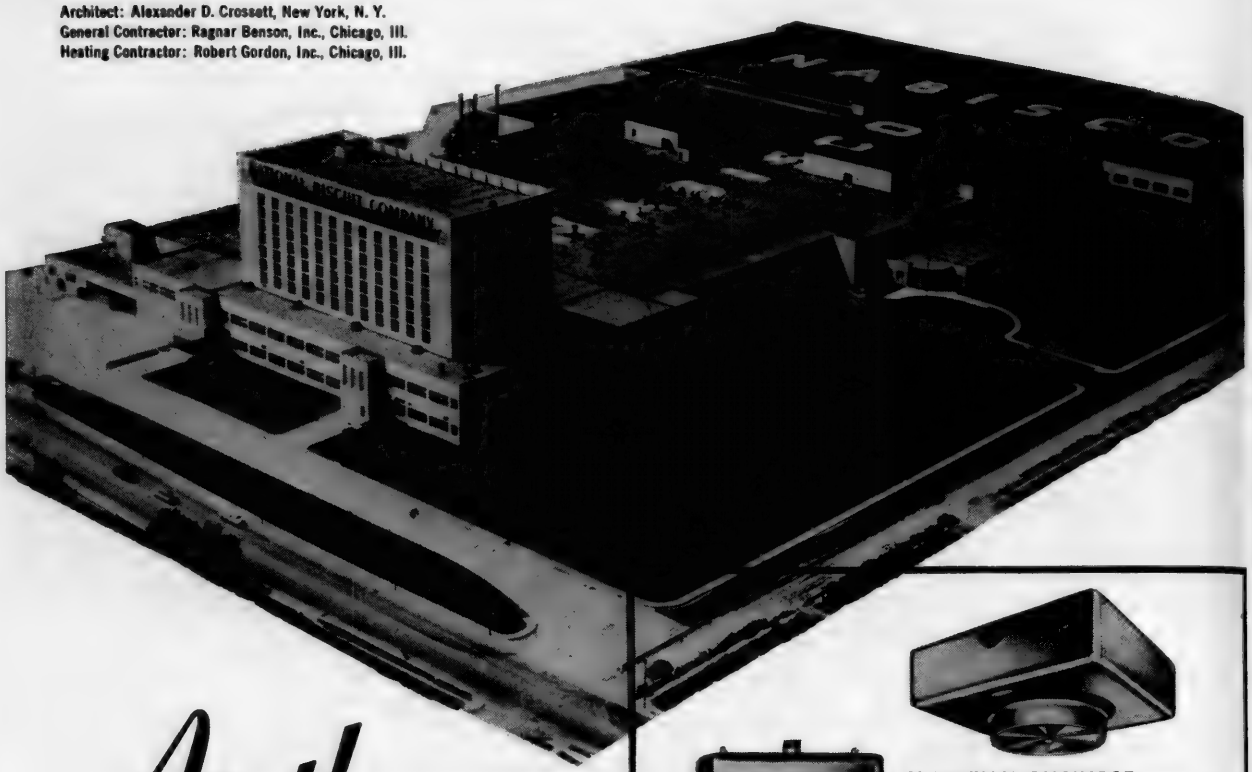
Company_____

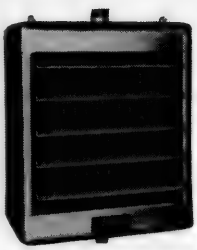
Street_____

City_____ Zone_____ State_____

National Biscuit Company
Chicago, Illinois

Architect: Alexander D. Crossett, New York, N. Y.
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.





90 VERTICAL DISCHARGE HEATERS INSTALLED from 102,500 BTU to 185,000 BTU

92 HORIZONTAL DISCHARGE HEATERS INSTALLED from 14,800 BTU to 250,000 BTU

Airtherm STEAM UNIT HEATERS

WARM THE WORLD'S LARGEST BAKERY

To achieve flexible, economical heating throughout Nabisco's new $20 million Chicago plant, 182 Airtherm steam unit heaters have been installed. The plant is the world's largest cracker and biscuit bakery with ovens the length of football fields, almost 20 acres of floor space and a capacity of 167 million pounds yearly.

When the area to be heated presents unusual problems, chances are you can solve them easily and economically with the flexibility of Airtherm unit heaters.

For Heating Satisfaction . . .
Think First of
Airtherm

Oil or Gas Direct Fired Heaters

Gas Fired Unit Heaters

Convectors

Centrifugal Fan Unit Heaters

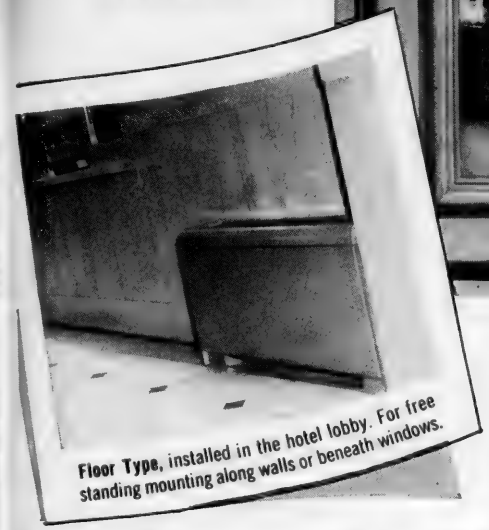
See Your Wholesaler, or Write

AIRTHERM MANUFACTURING COMPANY
722 S. Spring Ave., St. Louis 10, Mo.

AT-150

HOTEL DESOTO

SAVANNAH, GEORGIA

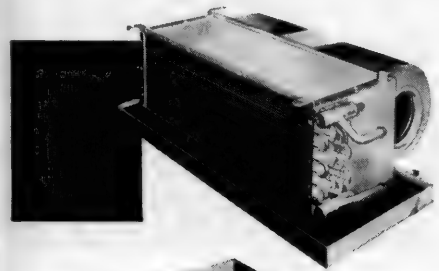


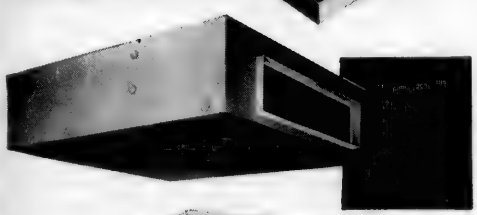
Floor Type, installed in the hotel lobby. For free standing mounting along walls or beneath windows.

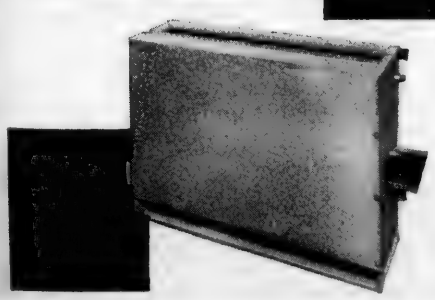
When the management decided to modernize Hotel DeSoto, Savannah, Ga., air conditioning, naturally, was one of the first considerations. J. Garnett Andrews, chairman of the board, and Charles G. Day, president, selected Mingledorff's Inc. as their air conditioning contractor. Through Savannah Refrigeration Supply, Inc., the local McQuay wholesaler, Mingledorff's purchased 183 McQuay Seasonmakers. Their installation assures Hotel DeSoto's guests of individual room air conditioning at its best.

Modernized with McQuay Seasonmakers

INDIVIDUAL ROOM AIR CONDITIONERS







● Famous McQuay Seasonmakers have made the luxury of individual room air conditioning practical for any multi-room building . . . for new or old construction . . . for hotels, tourist courts, apartment houses, office buildings, institutions and residences—wherever the best in air conditioning comfort is demanded.

Four types in three different sizes, 200, 400 and 600 CFM, simplifies your job of selecting a unit that will meet set requirements such as Floor type for free standing, Ceiling type for suspended mounting, Basic type for fully recessed wall installations as well as Hideaway type for concealed mountings in furred ceilings, closets, or vestibules. Quiet operation and flexible design allows you to select the correct unit for any job.

Exclusive Ripple-Fin coil construction assures long life and dependable service. Designed for easy installation and maintenance. Get complete details on features and specifications in Bulletin 703. Representatives in principal cities or write McQuay Inc., 1619 Broadway N.E., Minneapolis 13, Minnesota.

McQuay INC.

★ AIR CONDITIONING ★ REFRIGERATION ★ HEATING

To cut perfect threads

7 Points of uniform goodness in YOUNGSTOWN PIPE

uniform ductility
uniform lengths
uniform threading
uniform weldability
uniform wall thickness and size
uniform strength and toughness
uniform roundness and straightness

Youngstown

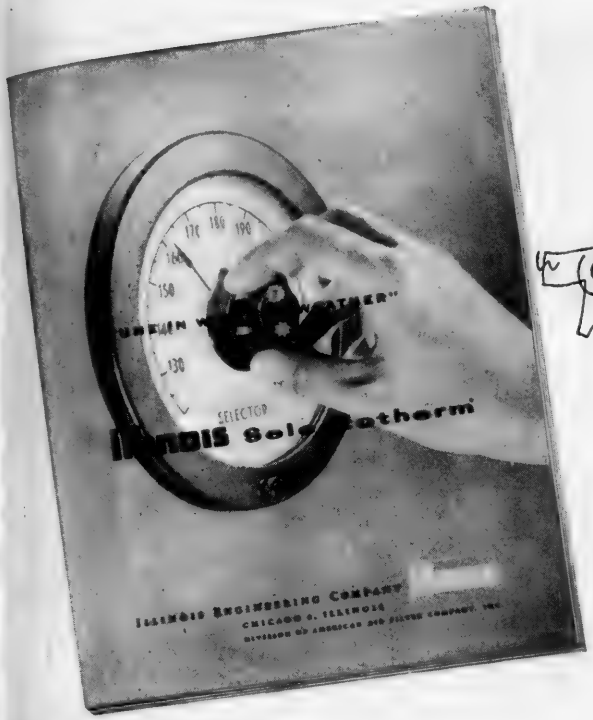
QUALITY · YOUNGSTOWN · SERVICE

●When the mechanical threader goes to work on Youngstown pipe, you can depend on it that the threads cut will be perfect and leak-proof. That's because the steel is of highest quality, controlled by a single manufacturer from ore mine to final inspection of the pipe.

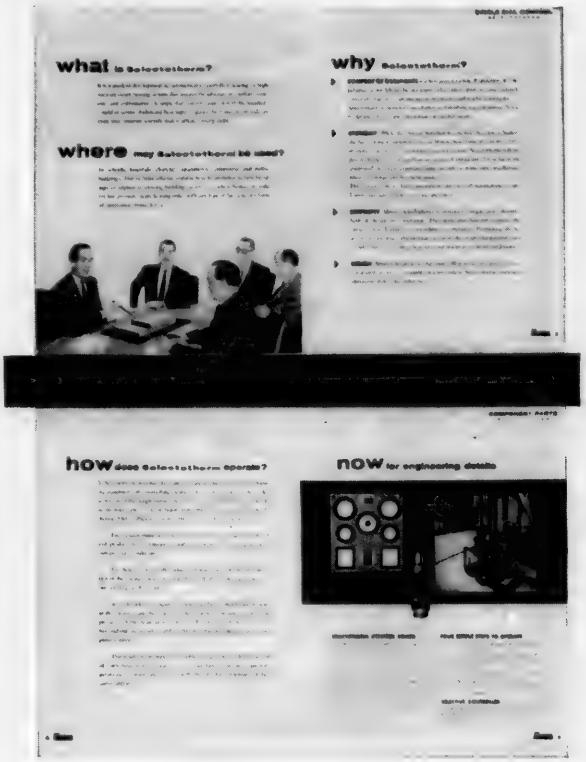
THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES



investigate this modern development in automatically controlled heating!



Send for your copy of this new 16 page bulletin—an interesting and easy to read description of Selectotherm advantages with engineering data.

To the architect and engineer an Illinois Selectotherm System with single dial control means lasting client satisfaction—to the heating contractor, simplicity and ease of installation—to the owner a sound investment that will pay big dividends in comfort, convenience and fuel economy.

illinois ENGINEERING

ILLINOIS ENGINEERING COMPANY

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DIVISION OF AMERICAN AIR FILTER COMPANY, INC.

Send today for your copy of the new Selectotherm bulletin that gives interesting engineering data.

Illinois Engineering Company
2045 South Racine Avenue, Chicago 8, Illinois

Send at once____copies of Illinois Selectotherm Bulletin 540 on Controlled Heating.

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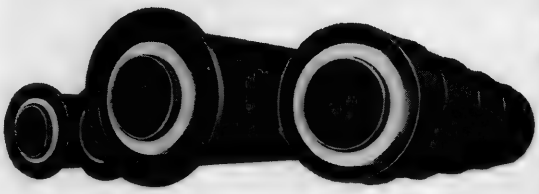
Company_____

Street_____

City_____ Zone____ State_____

EBKO PIPING SYSTEMS



CAST IRON STEEL

EBKO prefabricated insulated piping systems feature the most advanced design with positive security, outstanding economy, and unsurpassed quality for underground and overhead distribution of steam, condensate return, hot and chilled water, etc.

EBKO is—

- Durable
- Fire Proof
- Guaranteed
- Submersible
- Rugged
- Maintenance-Free
- Easily installed

Write today for additional information on EBKO Piping Systems.

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Since 1890
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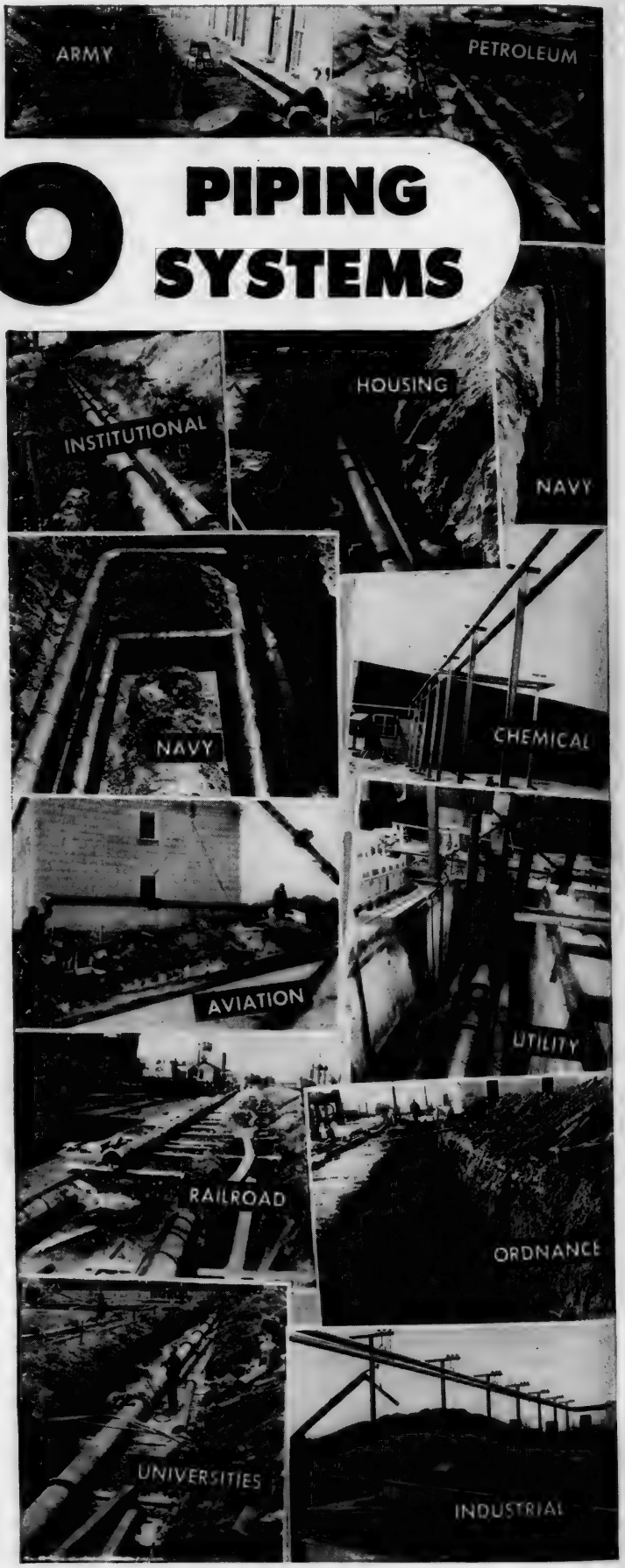
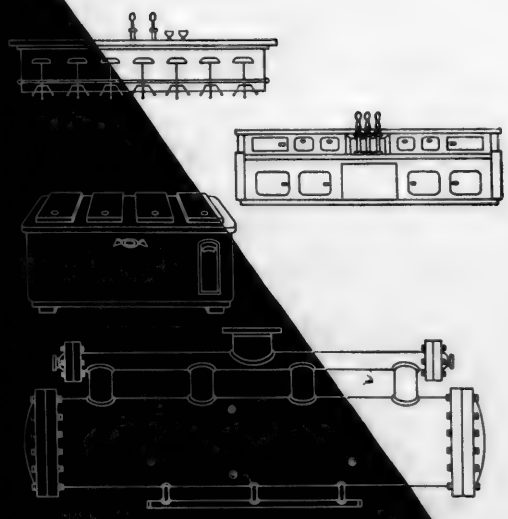
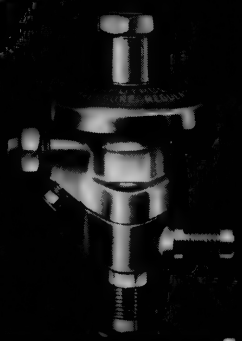
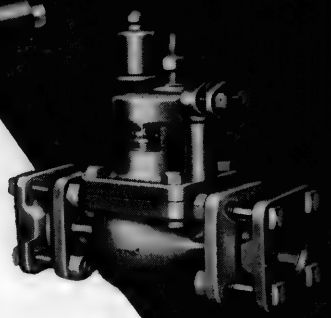


keep your coolers f







prevent freeze-up with ALCO

ENGINEERED
for service
for life

EVAPORATOR
PRESSURE
REGULATORS

They hold evaporator pressures to a predetermined point when the load changes. Available for any size water cooler—from drinking fountains to large industrial installations.

SEE YOUR ALCO WHOLESALER

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

ALCO VALVE CO.

MILE HIGH CENTER—

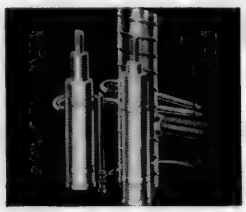
Another of America's newest buildings chooses a Yorkaire System of air conditioning!

Building after building, old and new, across the country is installing the Yorkaire System of Air Conditioning!

One of the more recent is the Mile High Center, being built in Denver. This magnificent 23-story structure will have walls made mostly of glass and it posed a "heat-load" problem of sizable proportions. York engineers—who have a great variety of systems from which to choose, who even design special systems to bring the *right kind* of air conditioning to unusual buildings—are furnishing a Yorkaire System as the perfect answer.

You can apply this knowledge and experience to your building. Call your York District Office (located in principal cities). Or write to York Corporation, York, Pa.

Webb & Knapp, Inc.—I. M. Pei, designer
Kerby Saunders, Inc.—mechanical contractors
Jaros, Baum & Bolles—consulting engineers
George A. Fuller Company—general contractor



Source of comfort cooling in this case will be two rugged 800-ton York Turbo Water Cooling Systems. "Raw" air, brought into the building is filtered, washed, cooled or heated, and moisture conditioned. When it's "just right," it begins its swift, silent journey • Through small, tightly sealed tubes, the "comfort" air is sent under mild pressure. Small pipes carry hot or cold water to help you obtain the temperature you want • In room units (1848 in the Mile High Center) air tube and water pipes converge. The conditioned air is released in a gentle, quiet stream. A simple control lets you refine temperatures to the conditions you desire.

IF YOU ARE ABOUT TO AIR CONDITION . . .

. . . consult with experienced York engineers. York brought the right kind of comfort cooling to the Empire State Building and the S. S. United States, *for example. Recent contracts include such buildings as the Esso Standard Oil Company in Philadelphia and Atlanta's Fulton National Bank.*

air conditioning by york

In homes and offices, ships and stores, skyscrapers, factories, hospitals, theaters . . . almost everywhere you go, when the air conditioning is just right, chances are it's York Air Conditioning.

YORK CORPORATION York YORK, PA.

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

air conditioning ducts

. . . installed in a matter of minutes with

DRIVE-IT SYSTEM

SPLIT SECOND FASTENINGS TO CONCRETE OR STEEL

Air Conditioning on the new Hotel Algiers in Miami, Fla., was speeded by use of Drive-it Fastening Tools.

Fastening overhead installation even in cramped conduit tunnels easy for new Drive-it 320.

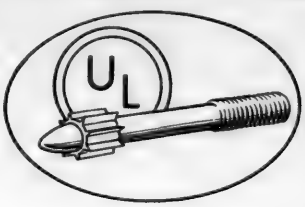
NEW EXCLUSIVE

DRIVE-IT 320

WITH

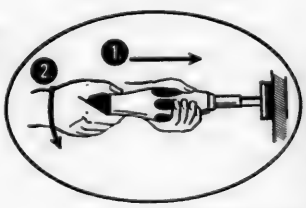
BREAK-OPEN ACTION

Snap open action results in the fastest operating tool on the market. Easiest method to load and eject cartridges under any condition.



Drive pins are Underwriters' Laboratories approved.

Controlled Power. First and only tool which requires but one standard power load regardless of penetration desired. No need to buy and stock various strength power loads.



Three-way Safety. Cannot be discharged accidentally, due to the push and turn firing sequence. This, plus the large, swivel safety pad, makes DRIVE-IT triple safe.

More fastenings per hour with this speedy way of loading and ejecting cartridges.

SEND THIS COUPON FOR FULL DETAILS

POWDER POWER TOOL CORP.
Dept. 2, 7526 S.W. Macadam Ave., Portland 1, Ore.
Canada: Ammo Power Tool Co., Ltd.
735 Broadway, Vancouver, B. C.

☐ Please send FREE catalogue and literature.
☐ I want a FREE demonstration of *DRIVE-IT*.

Name_____
Street_____
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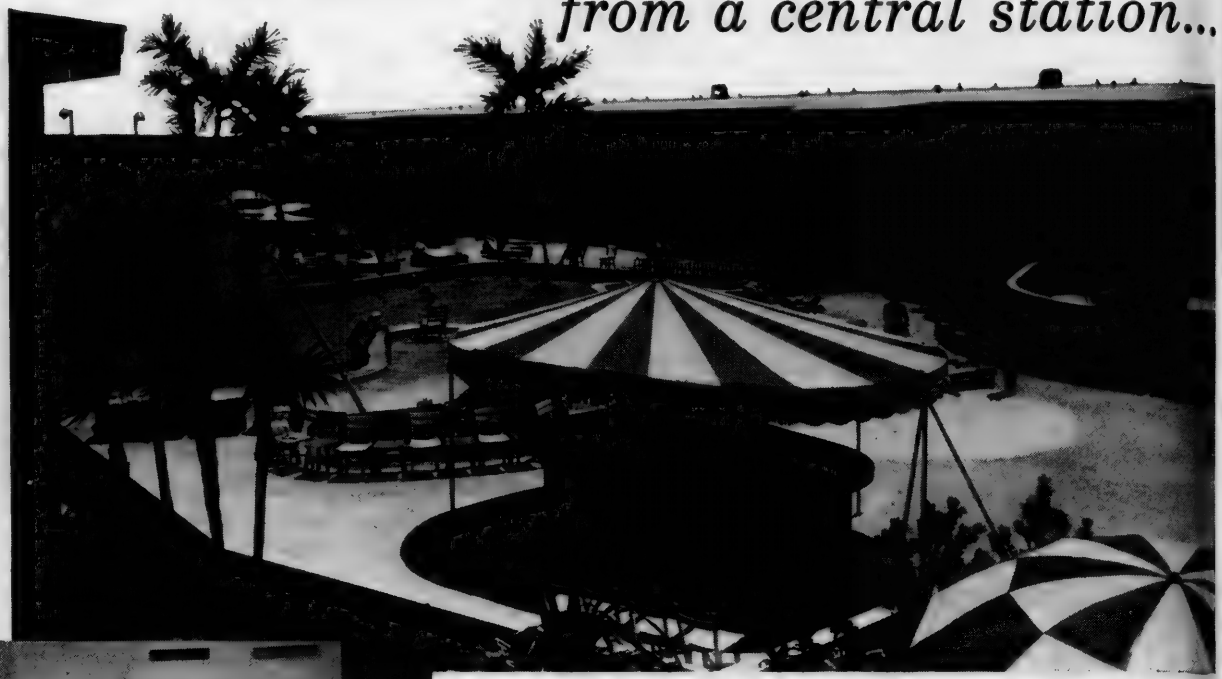
DRIVE-IT
the original **POWDER-ACTUATED TOOL**

in this smart miami beach motel

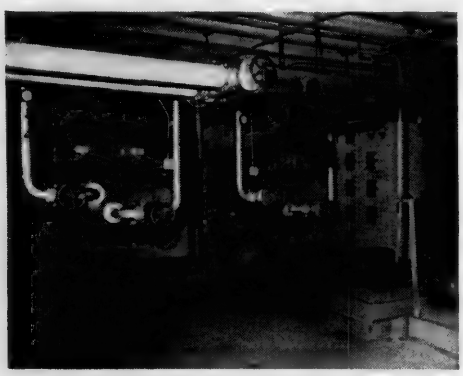
IT'S COOLING + HEATING

from a central station...



Sahara Motel, Miami Beach, Fla. *President:* Ben B. Gaines. *Architect:* Carlos B. Schoppl

Typical apartment of Sahara Motel, showing outlet (over door) for conditioned air and return air grille. Occupant can adjust thermostat to secure temperature desired, or shut off cooling or heating entirely.



Two Chrysler Airtemp "Packaged" Water Chillers from which chilled water for cooling is pumped through small pipes to concealed air conditioners which serve individual apartments.

BUT *with individual room control through a specially-engineered* CHRYSLER AIRTEMP SYSTEM!

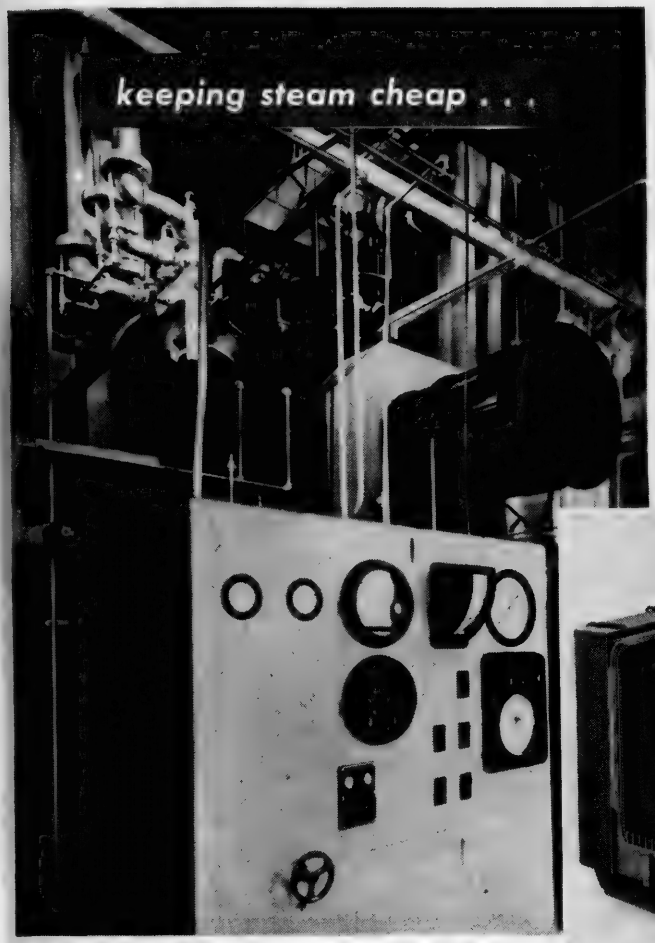
From a central station comes chilled water for cooling and warm water for heating in the Chrysler Airtemp Year 'Round Air Conditioning at the Sahara Motel in Miami Beach. But there the resemblance to conventional central duct air conditioning ends. The water, cold or hot, according to the season, is *piped* to overhead air conditioning units in each apartment. These self-contained air conditioners distribute cool air or warm air under thermostatic control, giving the occupant his choice of temperature at all times.

Chrysler Airtemp makes precision-built equipment for every type of air conditioning system—conventional or specially-engineered—in a modern air conditioned plant. And through Airtemp Construction Corporation, a wholly-owned subsidiary, offers architects, engineers and contractors a complete air conditioning service. See how this service can make your job easier! Just write Airtemp Division, Chrysler Corporation, Dept. HV, 1600 Webster Street, Dayton 1, Ohio.

CHRYSLER AIRTEMP

HEATING • AIR CONDITIONING for HOMES, BUSINESS, INDUSTRY

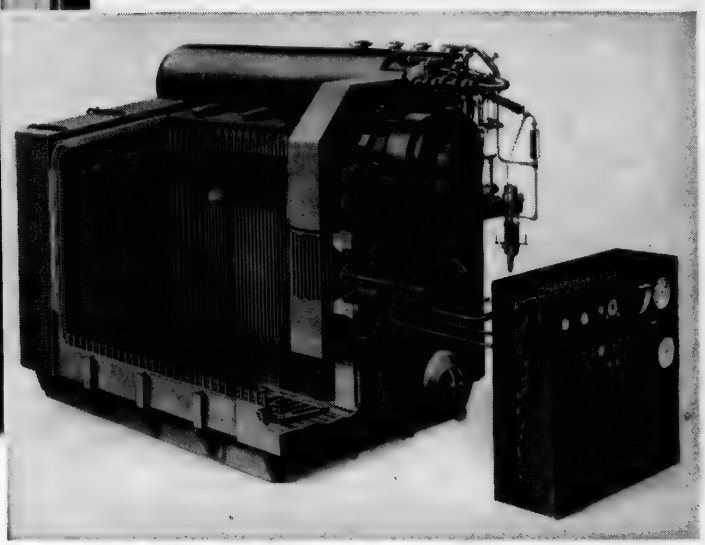
AIRTEMP DIVISION, CHRYSLER CORPORATION
Dayton 1, Ohio



One of the three B&W FM Boilers at the Buffalo Plant.

B&W Type FM Boilers Provide Economical and Efficient Steam Generation at

American - Standard



Typical arrangement showing sectional view of the FM Boiler and the control panel.

Since replacing five old units more than a year ago, three modern B&W Integral-Furnace Boilers, Type FM, have set and sustained high standards for economy and operating efficiency at the Stamping Plant of the American Radiator & Standard Sanitary Corporation in Buffalo.

Selected on the basis of previous experience with B&W Boilers—both FM and larger types—which are now producing steam at various other plants of the company, this multiple-unit FM installation has pleased both management and plant personnel. Overall boiler operating efficiency is 85%. Each of these versatile, self-contained, B&W units has a steam capacity of 27,500 lb per hr and is equipped with fully automatic controls. Designed for pressures to 250 psi, all three FM boilers are providing high pressure processing steam as well as steam for heating.

The choice of B&W FM boilers to supply plant steam requirements is an established trend that is putting more and more of these shop-assembled units into service for the broadest variety of industries, utilities, and other users, both here and abroad. Because it offers compact, "package boiler" benefits along with cost-saving big boiler advantages, B&W's FM Boiler is already in service or on order for a total steam capacity of more than 7,000,000 lb per hr. You can get this unique B&W "workhorse" in a range of standard sizes, for loads from 2900 to 28,000 lb of steam per hr at pressures to 235 psi. It is also obtainable for operation at higher pressures.

Features of B&W Integral-Furnace Boiler Type FM

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space

Write for Bulletin G-76 which gives complete details of the many cost-saving features of this popular, small boiler. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-634

BABCOCK & WILCOX

BOILER DIVISION

New Automaze air filter stays clean as new–automatically!

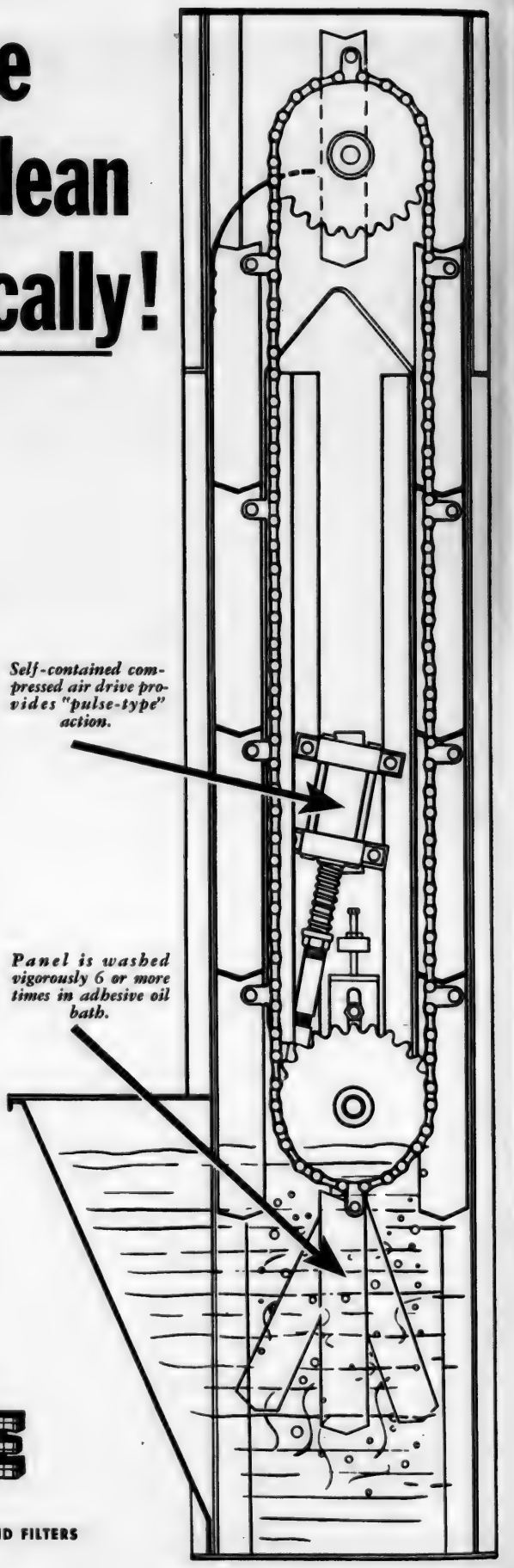
EVEN while filtering the dirtiest air, the new Automaze air filter stays clean as new—automatically! The reason is "pulse-type" action—an Air-Maze exclusive. Here's the way it works. While each panel in a revolving curtain is submerged in the cleaning tank at the bottom, it is agitated vigorously 6 or more times by a compressed air drive. This cleans each panel thoroughly as well as completely renewing the adhesive!

New Automaze is a big improvement over stationary filters that may need cleaning once a month. Automaze goes 3 to 6 months without attention. And then all you need do is remove the sludge. A special reservoir cover makes this a quick, simple operation.

Automaze has a rugged but ingeniously simple construction. Filter panels two inches thick are linked in a revolving curtain. Panels move up and over, like the cars on a ferris wheel. As a result, filter panels always keep the same face to the air stream. The dirty face of the filter is never on the downstream side. There's no possibility of dirt being blown off the filter into the cleaned air.

Here are some other important Automaze advantages: 1) Automaze has no electrical connections located in the air stream. 2) If desired, the Automaze control system can be remotely located. 3) A variety of media designs is available to meet different filtering conditions. 4) When sections are bolted together, there's no need for rigid mechanical drive connections that sometimes cause alignment difficulties—each filter section contains its own drive mechanism.

For the full story of the new Automaze, send for a free catalog. Air-Maze, the filter engineers, are specialists in all types of air and liquid filtration. We draw from over 29 years experience and thousands of different filter applications. So for help with your filter problems, contact your nearby Air-Maze representative or write The Air-Maze Corporation, 25000 Miles Rd., Cleveland 28, Ohio.


Self-contained compressed air drive provides "pulse-type" action.
Panel is washed vigorously 6 or more times in adhesive oil bath.

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS • LIQUID FILTERS
OIL SEPARATORS • GREASE FILTERS

NEW-RESIDENTIAL AIR CONDITIONER

Barkow

weatherwise FU UNIT

designed to fit furnace blower capacity!

Check these Barkow features:

- RATED CAPACITY — Maintains full capacity under extreme conditions
- COMPLETE PACKAGED UNIT — SHIPPED ASSEMBLED
- COMPACT — Occupies minimum floor space
- ALL PARTS ACCESSIBLE FROM FRONT PANEL
- FULL HERMETIC COMPRESSOR, CAPILLARY SYSTEM, F-22 FREON
- ALUMINUM FIN EVAPORATOR, Copper tube with capillary tube
- COUNTERFLOW CLEANABLE TYPE CONDENSOR
- CONTROL — High-low pressure switch, thermal overload and low voltage motor protection. Automatic water valve

Lightweight, Economical, Easy to Install. . . . It's the unit that makes year 'round home air conditioning a practical and economical reality! And it's a complete packaged unit, shipped assembled, ready for fast, easy installation.

The improved FU coil design reduces face velocity preventing coil icing and plugging. Its increased cooling efficiency, thus obtained, makes the FU adaptable to any size warm-air furnace without any of the usual costly changes. Available in 2, 3, and 5 ton sizes.

Dealers prefer the FU's simplicity . . . Owners praise its efficiency and its economy!

Write for Complete Details

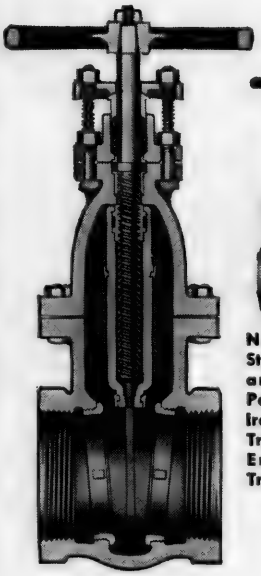
VALUABLE EXCLUSIVE TERRITORIES AVAILABLE

refrigeration division

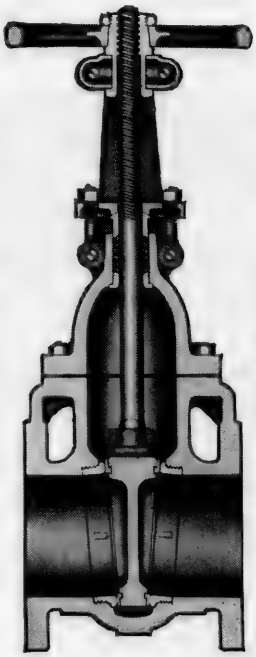
Aug. G. Barkow Mfg. Co., Inc.

2230 South 43rd Street Milwaukee 15, Wisconsin

Crane 125-Pound Iron Body Wedge Gate Valves are an improved design, embodying many features of unusual merit. They set a new peak for quality in iron body wedge gate valves, having greater strength, longer life, and better all-round adaptability for all types of services.



Non-Rising Stem; Screwed and Flanged Patterns; All-Iron or Brass Trimmed. Hub Ends, Brass Trimmed only.



Outside Screw and Yoke; Screwed and Flanged Patterns; All-Iron or Brass Trimmed. Also available with brass seats and steel stem.

See If You Don't Agree!

Here's the big value—the big selection: CRANE 125-Pound Iron Body Wedge Gates

. . . with quality features that assure exactly the kind of service you want. Body and bonnet are oval-shaped with extra metal where it's needed most, to provide liberal strength. Flanged patterns have tie-ribs between body and bonnet flanges. You also get a solid web-type disc with long guides . . . a stem of liberal diameter with long thread engagement . . . an exceptionally deep stuffing box with high-grade packing . . . a two-piece ball-type gland and flange—plus an easy-to-grip handwheel with oval-shaped rim. Non-rising stem valves have a brass bushed stem collar. OS&Y design includes a brass bonnet bushing, swinging eye bolts . . . and a tee-head disc-stem connection on sizes 12-inch and smaller.

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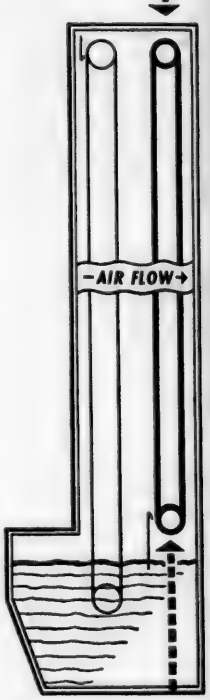

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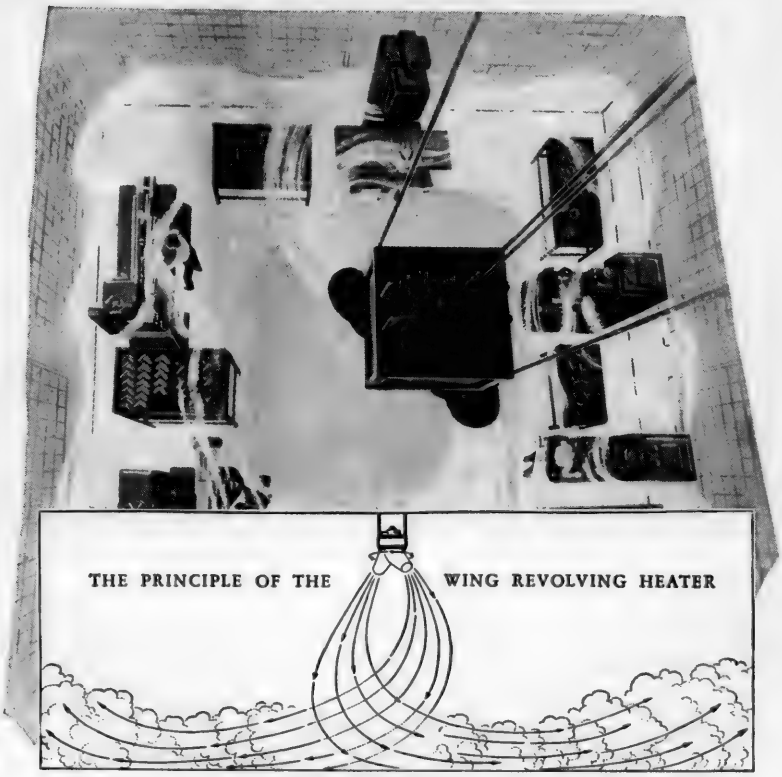

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Two Pacific Boilers for newest link in Federal chain

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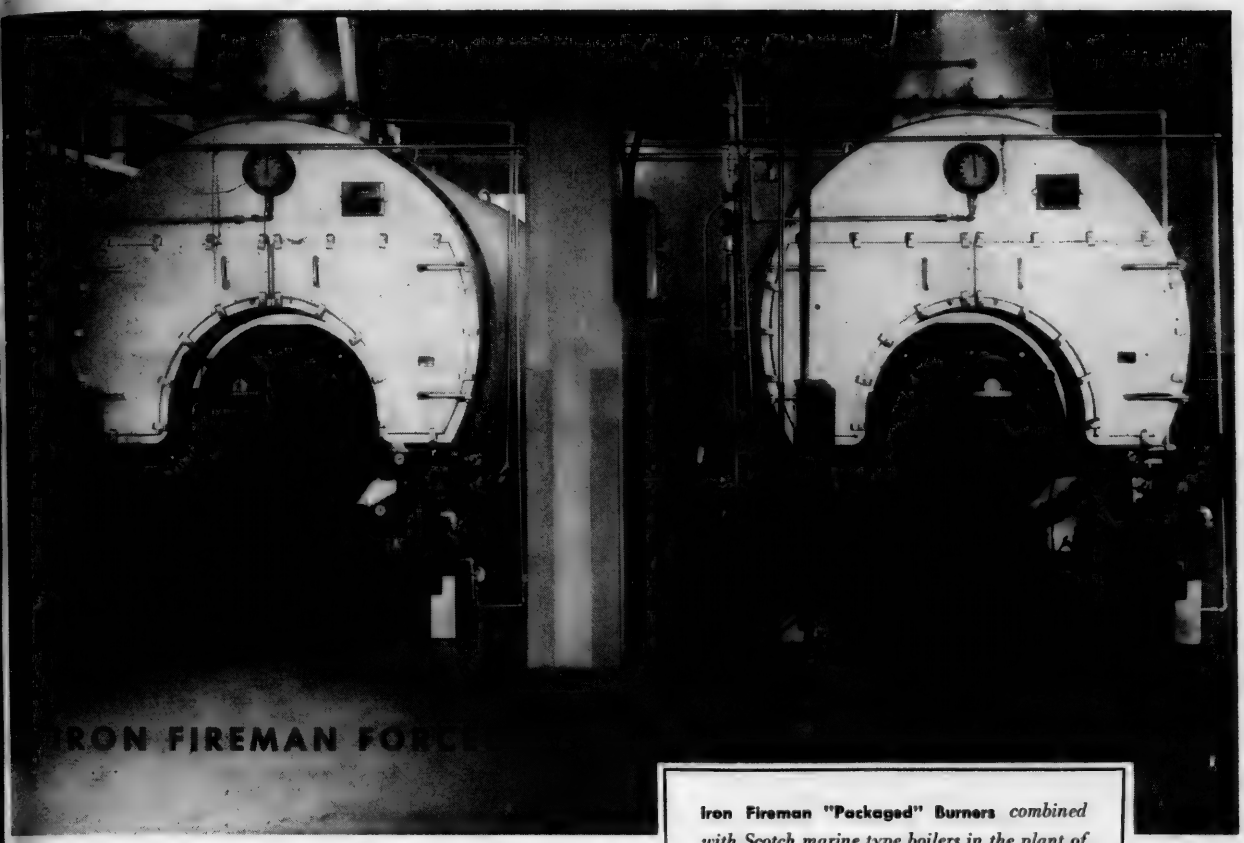

Iron Fireman "Packaged" Burners *combined with Scotch marine type boilers in the plant of Belrug Mills, Inc., Greenville, S. C. Installation by Kirby Hammond, Inc., Greenville. Race, Forrester & Etting, Architects and Engineers.*

No divided responsibility . . .

No separate contracts for (1) boiler setting (2) electrical wiring (3) oil heating equipment (4) automatic control system (5) forced draft system (6) boiler refractory

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The entire burner unit is assembled and tested at the factory, and is shipped to you ready for bolting to the boiler. Packaged unit includes: Iron Fireman oil, gas or combined oil-gas burner; wired and tested control panel; oil heating system; built-in forced draft with integral fuel and air controls.

Buy burner and boiler as integrated unit. You can install a complete new boiler plant quickly and economically by specifying an Iron Fireman packaged burner and a Scotch marine type boiler engineered specifically for use with this unit. Forced draft; no high stack required.

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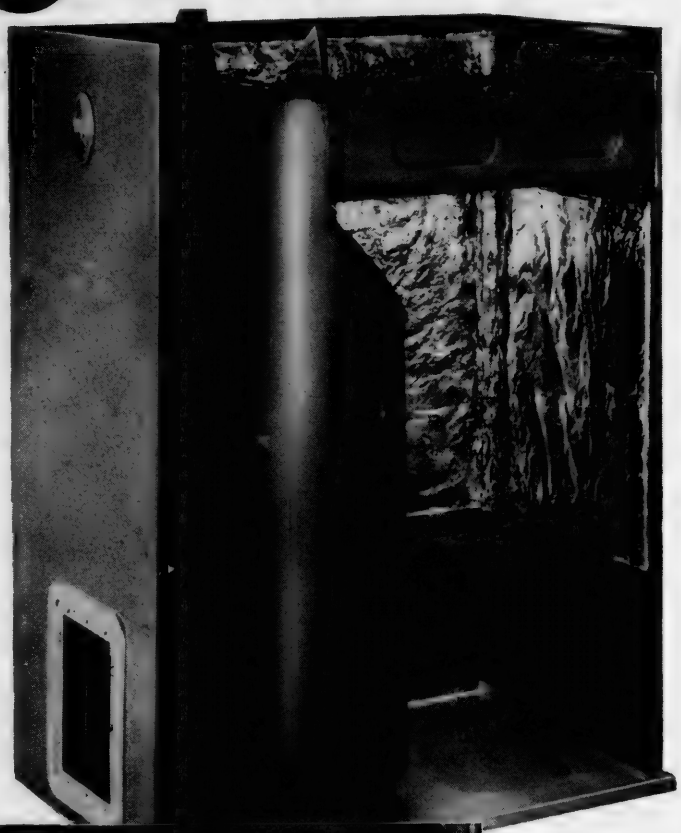

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1 Increases Efficiency

2 Reduces Temperature of Outside Casing

3 Reduces Outside Dimensions

4 Minimizes Noise

Super·Fine is easily applied. It is extremely lightweight and pliable. Here, foil-faced Super·Fine is being applied to interior walls of the interior casing of a Bryant gravity-type furnace. A high-temperature adhesive is used. Above, casings are shown in place. Ease of cutting is another production economy. The Super·Fine blanket can be easily cut with a sharp knife, scissors, or textile cutters. Perforated or tissue stencils or hardboard template may be followed for cutting.

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2. **Reduces temperature of outside casing;** makes unit safe to the touch. Super·Fine's millions of tiny air pockets provide superior resistance to heat flow, and aluminum facing nearly doubles this resistance.
3. **Reductions in dimensions** are often possible. Because of Super·Fine's high insulating efficiency, it can be placed in close proximity to the heating element, without unduly raising jacket temperature. This permits reductions of up to 2½" in outside dimensions of some units, with proportionate reductions in over-all weight.
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For further information about Super·Fine with binder #22 and foil facing, contact your nearest L·O·F office (offices in 26 cities). Or write: Libbey·Owens·Ford Glass Company, Fiber·Glass Division, 31-74 Wayne Building, Toledo 3, Ohio.

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(to cut your profit)

...then switch to the one line that meets every selling need

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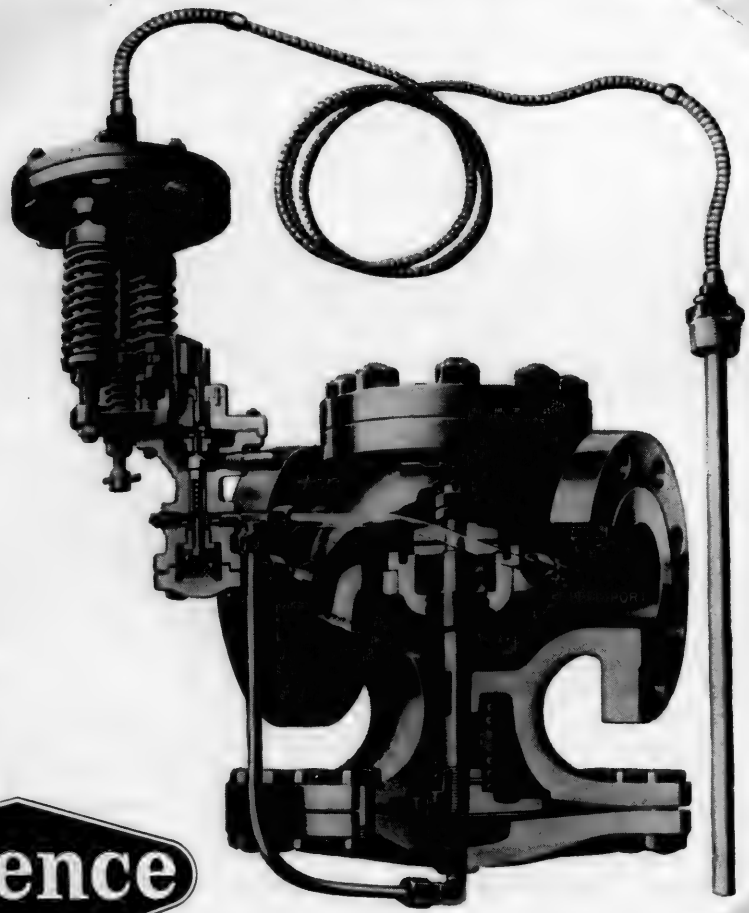
These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



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TYPE ET150
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SKIDMORE VACUUM PUMP

Automatically adjust to the varying conditions of the system. Capacities — ranging from 5,000 to 100,000 sq. ft. EDR. Available in both single and duplex units.

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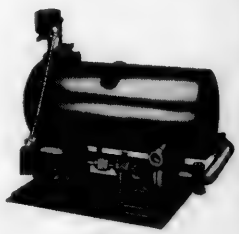
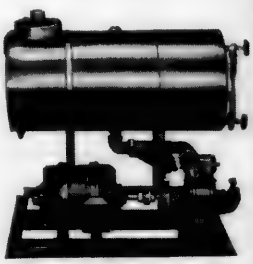
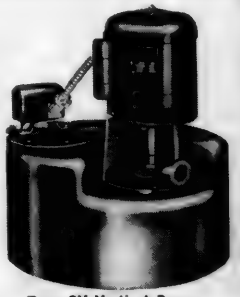


Type HS Condensate Pump



Type TM Turbine Pump



Type CV Vertical Pump

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If you are faced with the responsibility of a choice, Skidmore offers many types and units for you to select the correct design to meet your individual requirements.

Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

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Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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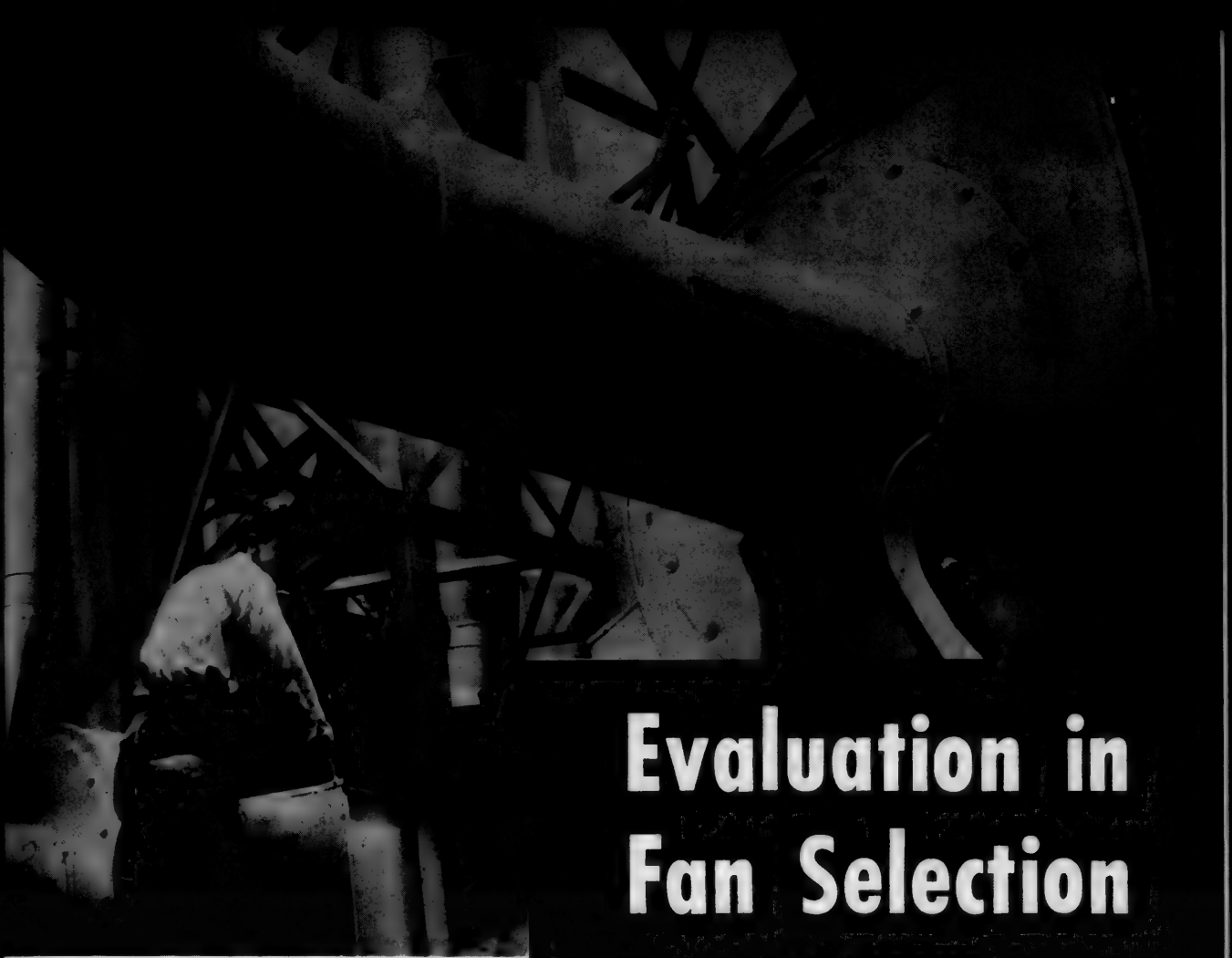

Evaluation in Fan Selection

A. N. ROGERS
Sturtevant Division, Westinghouse Electric Corp.
Hyde Park, Mass.

An economic analysis is important when selecting fans to obtain the best return for the money invested. A method of evaluating is presented and design calculations included to show how the data are used.

WHAT is the life expectancy of the air handling system you are planning for tomorrow? One year? Two years? Five years? Ten years or more from now? Remember, if the fan is in operation long enough, the cost of the power to operate the fan will eventually exceed the cost of the fan itself.

When specifications are written for fans to ventilate vehicular tunnels or to supply forced and induced draft for power generation, emphasis is placed on evaluated cost as well as first cost. In the evaluation of bids, the cost of electrical energy to operate the fans, over the amortization period or expected life of the installation, is added to the fan price. This procedure has become the normally accepted pattern and results in the most economical selection of equipment for the job. Why then, shouldn't the same principles of evaluation used by the engineers of such projects, apply to the thousands of every day jobs for which fans are selected?

Economic Balance is Important

Proper fan selection involves striking a proper balance between first cost and operating cost. The overall problem does not only concern itself with the fan but rather with the system as a whole. The fan, however, is the motivating force for the system and the system efficiency is reflected in the power it consumes. An economic analysis therefore must consider both the initial cost of the system and the cost of operation over the expected life period of the system.

In practice, the analysis is not as simple as it sounds due to the number of factors involved. The basic consideration in first cost is, of course, the cost of the equipment itself. This includes the cost of fan, accessories, duct work and erection. Other special factors may have to be taken into consideration depending on the particular application. In some buildings, space may be at a premium and the cost of additional space required for a more efficient fan and system may be prohibitive. Opportunities for investment may exist that would pay greater dividends than the savings in operation cost. Quietness of operation may be a vital element in which case the cost of an inherently quiet system may be balanced against acoustical treatment. In industrial systems involving corrosive atmospheres, the life expectancy and maintenance of standard equipment must be balanced against the additional cost of special metals or coatings.

Operating Costs

Costs involved in the operation of a fan system over its entire life, include maintenance, repairs, replacements and

Arthur N. Rogers, after two years at Northeastern University which he entered in 1941, was called in service and served with the Combat Engineers in both Europe and the Philippines. Following his discharge in 1946, he returned to Northeastern where he received his B.S. in Mechanical Engineering. While at school he worked for the B. F. Sturtevant Company on cooperative work assignments and during summer vacations. After graduation he joined the Sturtevant Division of Westinghouse and attended the Sales Engineering School. At present, he is a division sales engineer on general purpose fan products.

the cost of power to operate the system. Assuming the system to be properly designed and the equipment to be of quality construction, maintenance is to a great extent a nominal cost not subject to much variation. Therefore, we will concern ourselves mainly with power cost which is variable and yet controllable by careful apparatus selection.

Basic Points

The economics of system design is beyond the scope of this article, but a few words at this point might not be amiss. Air horsepower is the product of volume and pressure. Systems are normally designed for a specific volume which leaves pressure as the variable. The pressure required to force air through a system is dependent upon the resistance or friction loss through the various components. Friction loss or pressure varies essentially as the square of the velocity through the system components such as filters, coils and ductwork. For a given system if the velocity (volume constant) is doubled by using smaller ducts, the pressure and therefore the horsepower is four times greater. Two extremes of selection are possible: an inexpensive, high velocity system which takes little space but consumes a great deal of power; or a more expensive, low velocity, space consuming system which is economical to operate. There is a balance between the two extremes which is the most economical for a given set of conditions.

Assuming that the system as a whole has been designed with due consideration to the economic factors, fan selection requires first consideration using the power cost for one horsepower-hour over the total hours of fan operation during its expected life, the overall savings can be calculated for a fan of greater efficiency. Multiply power cost per KW hour by yearly hours of operation times 0.746 to get the cost of one fan brake horsepower difference per year. (The motor efficiency will of course effect the overall difference. However, motor efficiencies are generally comparable and are therefore being neglected.) This multiplied by the number of years of expected life gives the total cost of one horsepower or the savings resulting from each horsepower reduction from a more efficient fan. Where fans and related equipment are generally considered to be a permanent part of the structure, their life expectancy ranges generally from ten to twenty years or more. Cost of energy should include the average demand charge, although in most cases the effect of fan horsepower on demand charge is negligible.

Take for example a power cost of 1.5 cents per KW hour and a fan operation of 40 hours per week, 50 weeks per year.

$.015 \times 40 \times 50 \times 0.746 = \$22.40$ per year per horsepower

Over a ten year period, this is a total of $224 per horsepower. It is a relatively simple matter to calculate the total cost per horsepower for any given set of requirements.

In addition to the power savings derived from greater fan efficiency, there is also a cost reduction on wiring and related electrical equipment due to the smaller loads. On an existing wiring system, a more efficient fan or fans could make the difference between overloading or not overloading the electrical system.

Fan Characteristics

Before going into actual example of fan selection on an evaluated basis, basic fan characteristics should be reviewed briefly. Fans, like motors and other mechanical apparatus, are designed for a specific duty and the design performance is the performance at maximum efficiency. Fans, again like motors, are manufactured in a range of sizes in increments which will permit a selection at, or close to, maximum efficiency for most any volume and pressure requirement. Fan performance is commonly referred to in terms of static pressure and static efficiency and the remaining discussion will be confined to those terms, rather than total pressure and mechanical or total efficiency.

Let us take a typical percentage characteristic curve of a non-overloading centrifugal fan and plot an additional curve of outlet velocity at one inch static pressure, Fig. 1. (This curve is independent of fan size and is plotted on the basis of outlet velocity for a given fan pressure divided by the square root of the pressure produced.) We can now enter the curve if we know the volume and static pressure, and the fan size (outlet area) desired. That is, the volume divided by outlet area gives outlet

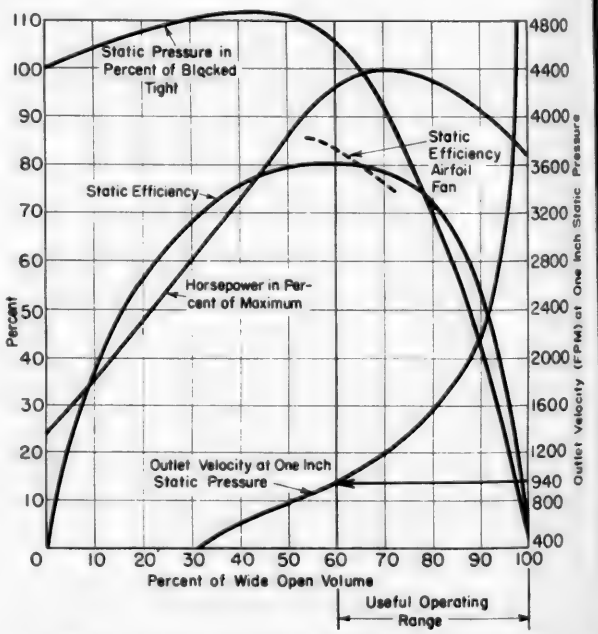

Fig. 1. Typical percentage characteristic curve of a non-overloading centrifugal fan.

velocity and this, divided by the square root of the static pressure, gives the outlet velocity at one inch static pressure.

Using this curve we can gain considerable knowledge of fan performance characteristics in general. The design performance point for this fan is at about 60 percent of wide open volume. This corresponds to an outlet velocity of 940 feet per minute at 1 inch static pressure (SP). As we approach wide open volume, the outlet velocity (OV) at 1 inch SP increases and the efficiency decreases, until, at wide open volume the OV at 1 inch SP becomes infinite and static efficiency becomes zero. Also, as OV at 1 inch SP becomes less than the design point of 940, the efficiency again decreases. To find the corresponding outlet velocity for other than 1 inch static pressure, multiply OV at 1 inch SP by $\sqrt{SP}$. Thus at maximum efficiency, the outlet velocity for 2 inch SP is 940 $\times$ 1.414 = 1,300 fpm and for 4 inch SP, 1,880 fpm. From this it is obvious that, for a given efficiency, the higher the pressure, the higher the permissible outlet velocity. The common practice of assuming a specific outlet velocity for fan selection for all static pressure requirements overlooks this fact.

Fans, unlike most other mechanical equipment, are not limited in operation to the design point and its vicinity. In most cases, the fans are operating overloaded, that is, beyond the design volume. This is of course a design overload rather than a mechanical overload. The useful operating range of a fan is from the maximum efficiency point out to wide open volume. Within its mechanical limitations then, any given size of fan can deliver an extremely wide range of pressures and volumes at varying speeds and efficiencies. Because of this leeway in fan operation, there is a tendency to select fans at uneconomical efficiencies in order to obtain a low first cost.

This curve is representative of non-overloading fans in general. Designs of various manufacturers will differ in the position of the design point, maximum efficiency value, and efficiency at various points in the operating range. Some fans may be designed for lower peak efficiency but with higher efficiencies out toward wide open volume. Industrial fans, multiblade fans, and other fan types have distinctive characteristic curves but will follow the same general rules. (See Fig. 2.)

The static efficiency for a fan with airfoil* blading is shown plotted for the same outlet velocity at 1 inch SP. The efficiency peak is about six points higher but at a lower outlet velocity and drops below that of the standard fan at about 1,050 fpm at 1 inch SP. To realize the benefits of the higher efficiency, it is necessary to select a fan that provides the lower outlet velocity.

* Airfoil, or streamline blade design is used by some manufacturers to increase the efficiency of none-overloading fans.

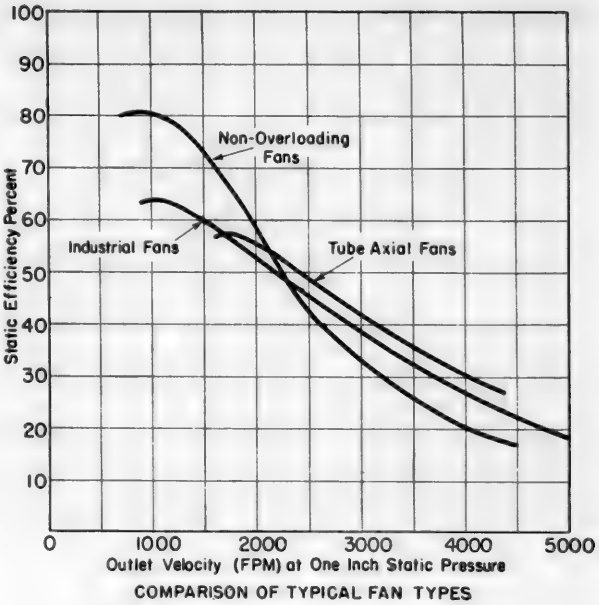

Fig. 2. Comparison of typical fan types.

Turbulence and other air noise-producing factors are at a minimum in the area of maximum efficiency. Also, the pressure produced for a given fan speed is near maximum in the vicinity of peak efficiency and the required speed for a given pressure correspondingly less. These two factors combine to give a definite advantage of quietness of operation when fan selection is at or near maximum efficiency.

Note that for outlet velocities at 1 inch SP less than that required for maximum efficiency the fan is underloaded—that is the fan is too large for the given duty. A selection in this area would be uneconomical except under very special conditions.

Design Calculations

Air horsepower at standard conditions (0.075 density dry air, 70F, 29.92 inches barometer) can always be found by multiplying volume (in cfm) times static pressure (inches of water) times the constant 0.000158. The air horsepower divided by the static efficiency of the fan gives the brake horsepower required by the fan. Thus for 25,000 cfm at 2-inch SP at 70 percent fan static efficiency:

$$\text{Air horsepower} = 25{,}000 \times 2 \times .000158 = 7.9 \text{ hp}$$

$$\text{Fan horsepower} = \frac{25{,}000 \times 2 \times .000158}{.70} = 11.3 \text{ hp}$$

Suppose we take the cost per year per horsepower at $22.40 as found previously and the working conditions

TABLE 1—EVALUATION OF FANS FOR 25,000 CFM AT 1-INCH SP
Power Cost, $22.40 per Year per HP

Fan Size (Sq Ft Outlet Area)	Fan Cost	Air Horse-power	Outlet Velocity 1-Inch SP	Static Effi-ciency	Fan Horse-power	Total cost = Fan cost + operating cost = Fan cost + ($22.40 × Fan HP × Years			
						1 year	2 years	5 years	10 years
6.28	$539	3.95	3980	.21	18.8	$960			
7.66	610	3.95	3260	.31	12.7	895	$1180		
9.35	708	3.95	2680	.40	9.9	930	1152	$1818	
11.41	815	3.95	2190	.54	7.3	978	1141	1630	$2445
13.91	984	3.95	1800	.66	5.98	1118	1252	1654	2324
16.98	1177	3.95	1475	.74	5.34	1296	1415	1772	2367

TABLE 2—EVALUATION OF FANS FOR 25,000 CFM AT 2-INCH SP
Power Cost, $22.40 per Year per HP

Fan Size (Sq Ft Outlet Area)	Fan Cost	Air Horse-power	Outlet Velocity		Static Effi-ciency	Fan Horse-power	Total cost = Fan cost + operating cost = Fan cost + ($22.40 × Fan HP × Years)			
			2-Inch SP	1-Inch SP			1 year	2 years	5 years	10 years
5.15	$474	7.9	4850	3430	.29	27.2	$1084			
6.28	539	7.9	3980	2810	.37	21.3	1016			
7.66	610	7.9	3260	2300	.50	15.8	962	$1314		
9.35	708	7.9	2680	1890	.63	12.5	988	1264	$2108	$3508
11.41	815	7.9	2190	1550	.72	11.0	1061	1307	2045	3285
13.91	984	7.9	1800	1270	.76	10.4	1218	1450	2189	3314
16.98	1177	7.9	1475	1040	.80	9.9	1399	1627	2287	3397

of 25,000 cfm at 2-inch SP and evaluate fan selection for a number of years. For this we will use typical prices and the fan curve of previous reference. The tabulation of results is listed in Table 2. Even on the basis of one year of operation we can evaluate the fan at fifty percent efficiency and realize a savings of $54 after paying off the additional investment of $71 over the smaller size fan. The fan at 50 per cent efficiency cost $610 and the fan size smaller costs $539 giving a difference in fan price of $71. The cost of fan plus operation for the 50 percent efficient unit is $962 against $1,016 for the size smaller giving a difference of $54. Both figures include the fan cost so that the $54 difference is the overall savings after paying for the more efficient fans. At 63 percent efficiency, a 15 hp motor can be used with a corresponding saving in motor, starter and wiring cost. If the life of the installation is five to ten years, a selection at 72 percent efficiency can be evaluated.

If we keep power cost and volume the same, but reduce the pressure to one inch we find results tabulated in Table 1. On the basis of one year of operation we can evaluate only 31 percent efficiency. After two years and ten years we can evaluate 54 and 66 percent efficiency respectively by proper fan selection. Smaller motors again increase the possible savings. For such a large volume at only one inch static pressure we are reaching the normal limit of centrifugal fan effectiveness and at lower pressure, an axial flow type of fan would often be a better selection for industrial applications. Axial flow fans in general are designed for large volumes at low pressures. See Fig 2.

Table 3 is the evaluation on a similar basis except the pressure is increased to four inches.

For one year of operation, the evaluation is at 71 percent efficiency and in ten years we can evaluate at 80 percent or almost peak efficiency. (At higher pressures we could begin to investigate the Airfoil fan and, at 8 inch pressure this fan could show an overall saving on the basis of five to ten years despite the higher cost.)

In Tables 1, 2 and 3, the underlined figures indicate the evaluated selection, in other words, the lowest total cost of fan and operating costs for the length of time indicated.

The higher the pressure for a given volume, the higher the efficiency which can be evaluated. The reasons for this are threefold: (1) Since the basic power consumption is higher, therefore, overall power cost adds up faster; (2) for a given volume, the higher the pressure requirement, the smaller the fan size for a constant efficiency; (3) the price increments between smaller size fans are less. Therefore, added power costs cover the price differential between fans more quickly.

At this point a mention of the fallacy of fan selection based on duct size or outlet velocity might be pertinent. At a given outlet velocity fan efficiency is dependent on the pressure—conversely for a given efficiency, outlet velocity is dependent on pressure. Fans should be selected on the basis of efficiency, therefore the outlet velocity should vary depending on working conditions, economic and other design considerations. The fan outlet area should have no particular relationship to duct area. A simple transformation piece can be used to increase or decrease the area.

Evaluation Trend

After examination of the tables, we can perceive the general trend of the evaluation. As can be expected, the longer the life of the installation, the higher the efficiency that can be evaluated. The reason for this is that the initial fan cost always remains the same but to it are added more and more years of power cost.

You will note that all of the tables are based on the cost of fan plus cost of operation over various periods of time. In effect, they indicate the number of years required to pay off the additional investment for the larger and more efficient fan. The table could be carried out to 15, 20 or more years and in that length of time even larger and more efficient fans could be evaluated. On this basis, of course, the evaluation would be a fallacy because of the

TABLE 3—EVALUATION OF FANS FOR 25,000 CFM AT 4-INCH SP
Power Cost, $22.40 per Year per HP

Fan Size (Sq Ft Outlet Area)	Fan Cost	Air Horse-power	Outlet Velocity		Static Effi-ciency	Fan Horse-power	Total cost = Fan cost + operating cost = Fan cost + ($22.40 × Fan HP × Years)			
			4-Inch SP	1-Inch SP			1 year	2 years	5 years	10 years
5.15	$474	15.8	4850	2430	.45	35.1	$1262			
6.28	539	15.8	3980	1940	.61	25.8	1117	$1695		
7.66	610	15.8	3260	1630	.71	22.2	1107	1604	$3095	
9.35	708	15.8	2680	1340	.77	20.5	1167	1625	3003	$5298
11.41	815	15.8	2190	1100	.80	19.7	1256	1697	3020	5225
13.91	984	15.8	1800	900	.808	19.6	1422	1860	3174	5364

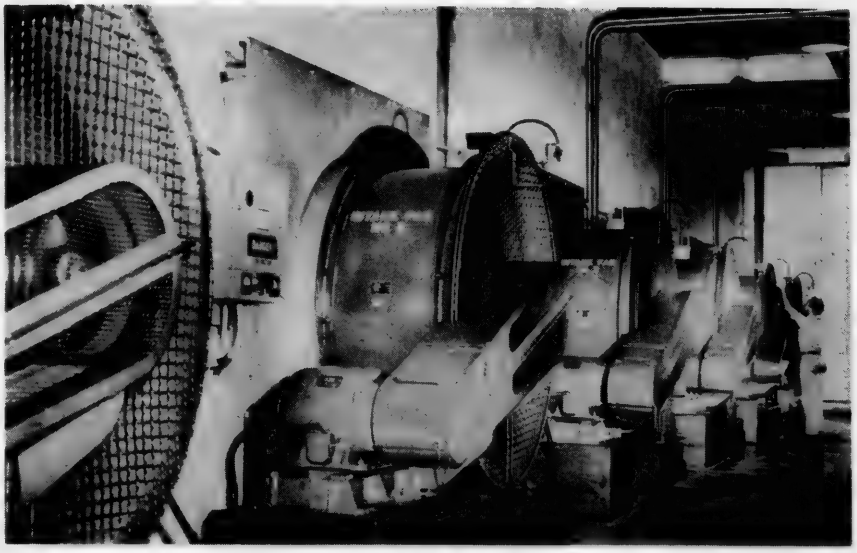

Fig. 3. Multiple fan installations increase the importance of properly evaluated selection.

small return. It is obvious that the longer the time required to pay off the additional investment, the smaller the return. A fan that will pay for itself in 20 years is offering only a 5 percent return which is hardly an inducement since investment in high grade securities may offer as much and the principal remains intact. Even the ten years shown in the tables is stretching a point and it is an exceptional case where an evaluation can be carried out to this length of time. On the other hand, an additional investment which will pay for itself in one or two years is almost universally acceptable and most industrials will accept four to five years which represents 20 to 25 percent return.

The average heating, ventilating and air conditioning fan is in operation ten years or longer. Therefore, the table would indicate that any selection much less than 65 to 70 percent efficiency is uneconomical for this type of work. In the example, the hours of operation are conservative and the power costs somewhere near average. Fan operation is generally considered to cost somewhere between $25 and $50 per year per horsepower with all factors taken into consideration. (A large industrial concern in the Middle West uses $40 per horsepower for five years or $200 per horsepower saved.) The lower figures were used to indicate that fan operation can be evaluated at some point regardless of conditions. Average consumer prices for Class I fans were used for comparison purposes even though Class II fans should be used for the 4-inch pressure conditions.

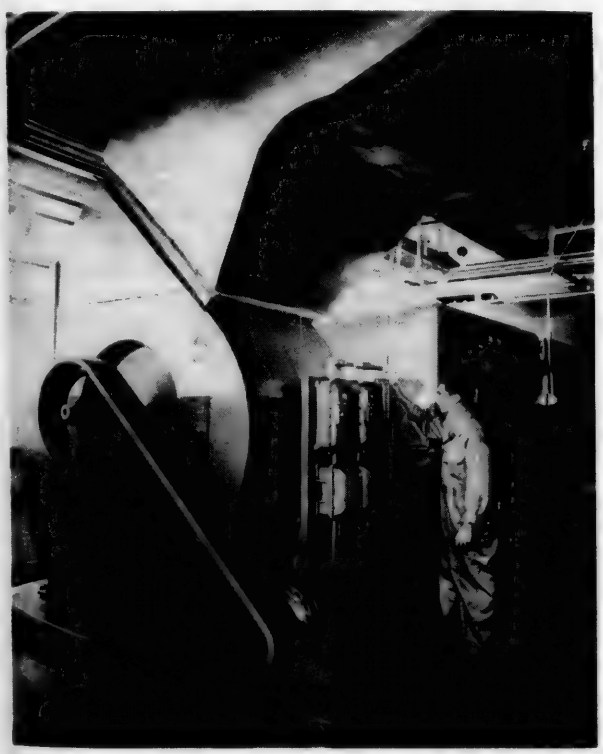

Fig. 4. Non-overloading fan installed in process air conditioning system.

Industrial fans are inherently less efficient than non-overloading fans because they are designed for different conditions. See Fig. 2. Due to the higher pressures usually encountered, however, industrial fans can be evaluated close to their peak efficiency of 55 to 65 percent.

A similar type of analysis can be applied to volume control equipment for fans. Depending on the hours of operation at reduced volume, percent volume, percent volume reduction and the working conditions, dampers, inlet vane control, fluid couplings or multiple speed motors may be most economical. It is impossible to cover all possibilities of evaluation in selecting fan and accessory equipment in this article but the potentialities should be apparent from this discussion. How then, can the average system designer be sure to get the most economical selection? There are three possible methods: (1) the designer can make his own analysis from catalog data and approximate prices and make his own equipment selection; (2) he can enlist the aid of the representative of a reputable fan manufacturer to help with the equipment selection; (3) specifications can be written covering the basic requirements plus an evaluation clause. This clause should state that, to the fan or equipment price, the cost of operation of so many dollars per horsepower will be added and the low bid will be selected on the combined cost. With this type of specification, the bidder will automatically present the most economical selection of equipment that he has available.

Future of Air Conditioning in Large Buildings

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Techniques of air conditioning have not kept pace with the greater use of cooling in large buildings. There is need for a simpler system and for means which will reduce the space now required for air conditioning systems. Interesting observations are presented regarding possible future designs.

DEVELOPMENTS of the last twenty years have changed our conception of air conditioning from that of a semi-luxury to a fundamental necessity in the consideration of new buildings whether they be used for offices, public assembly, department stores, apartment houses, hospitals, hotels or other continually occupied space. Unfortunately, the techniques of air conditioning have not kept pace with this increasing demand. There are, for example, many things involved in the conditioning of large buildings beside the introduction of clean, properly conditioned air and the evacuation of it after it is partially vitiated.

There are such factors as space for central apparatus, space for cooling towers, loss of usable floor area to care for networks of conduits carrying the conditioning fluid or fluids, intrusion of the air conditioning distribution system into the scheme of decoration and physical arrangement cost of the original installation, cost of operation and maintenance and other considerations which vary with the particular requirements of the building. But principally the air conditioning system must satisfy the greatest number of individual ideas of comfort among the buildings' occupants.

Cost and Space

Note that among the seven factors listed, three relate to space and three relate to direct cost of air conditioning. However, the three factors relating to space can affect the cost of the building much more than the direct cost of conditioning. For example, the entire mechanical equipment cost excluding elevators and electrical work will average less than 15 percent of the total building cost, but it is estimated that the overall cost for an air conditioned structure will be approximately 18 percent higher than a similar building with equal usable area without conditioning. This indicates that by far the largest item of cost in the conditioned building is the cost of the structure due to additional height and floor area to accommodate the air conditioning system.

Some efforts have been made to reduce the space used by air conditioning, but they have not been definitive, and consist mainly of the use of "high pressure, high velocity" duct systems which are neither high in pressure nor velocity except by comparison with methods that have been in use for many years.

There are many indicated avenues of development but for conciseness, the article will be confined to three major factors. The heat extraction and addition for determining the proper calorific value of the conditioning fluid; the distributing system of conditioned fluid or fluids; and the flexibility of operation and control of temperatures and humidities.

Our aim should be the development of a system of air conditioning that occupies little space, has a low initial and operating cost, is simple to operate, has long life, few moving parts, and one which is so flexible that any individual can change the atmosphere immediately around him to balance his instantaneous metabolic rate, his clothing, his neurotic reaction, the time of day and his changing moods.

All this sounds a little far-fetched but it is surprising how often yesterday's fantasy becomes tomorrow's standard practice. We never realize all our objectives, but our history has been one of constant improvement and gradual elimination of awkward methods and poor efficiency.

System is too Complex

Air conditioning, as was pointed out, includes many factors besides control of temperature and relative humidity, but it starts with control of the heat content of the circulated air. Current practice is to extract heat from the air by a complex system of refrigeration and heat exchangers. First we conduct outdoor air through a cooling tower to remove heat from water. This water is passed through a heat exchanger to extract heat from a refrigerant (usually a complex chemical compound which has characteristics that require its segregation from the rest of the building by means of many safety devices and special arrangements). The refrigerant then takes heat from a second circulating water system, and finally this water removes heat from the conditioned air used to produce comfort. The steps are: Air to water to refrigerant to water to air. Silly isn't it? Even sillier is the fact that at each point of exchange, a new prime mover is added with consequent additional power requirement. That is present practice.

Our aim for this phase of the system should be outdoor air to extract heat from the conditioned air. One step, instead of four. This is perfectly possible in theory. Over twenty years ago, de Bothezat developed a possible method which was based on recovery of energy in sufficient amount to keep the power requirement within suitable limits. Even earlier, one of the steps had been eliminated by the use of water as a refrigerant. Both of these ideas have been shelved or forgotten, whether as a matter of policy or lack of appreciation, I do not know. So many things are started and later abandoned before all possibilities are explored. The very use of water as a refrigerant, or direct extraction of heat from air to air, eliminates most of the restrictive devices and arrangements required in connection with the more complex chemicals in general use.

The addition of heat to the air is generally supplied

J. W. Kreuttner, vice president and member of the Board of Directors of Buensod-Stacey, Inc., is a graduate of Columbia University School of Engineering and has had over 25 years experience with companies devoted to the design and installation of air conditioning systems.

First employed by W. L. Fleisher Company in 1924, he was with this company when it merged to form Cooling and Air Conditioning Corp.—first as design engineer and from 1928-34 as assistant chief engineer. In 1934, Mr. Kreuttner became one of the founders of Air & Refrigeration Corp. and served as its vice president and chief engineer until 1944 when he also became general manager. During this period he made special studies of air conditioning and ventilation for industry.

He has been with the present company since 1950. This article was first presented as a paper before the annual meeting of the Building Research Institute held at Hershey, Pa.

through a network of steam or water conduits distributed through the building to heat the conditioned air as required in local areas. This is a double network, supply and return, in addition to the two (supply and return or exhaust) networks of air conduits. Why do we need these two additional sets of conduits and why an additional conditioning fluid? Any fluid will convey heat, so why not use air? This would require a third network of air conduits, one cold supply, one warm supply, and one exhaust or return network. I am going to use that word "network" a lot before I am through.

A distinct advantage of the all air system is that when a small leak develops in a water or steam line, immediate and sometimes drastic attention is required. A small leak in an air conduit causes little or no damage and may never require repair. After all it is conditioned air leaking into conditioned space, and it does not cause water damage to expensive interior decoration or by accumulation, damage to the building structure.

Two Systems of Air Conduits

The air conditioning distribution system gets us back to our networks again. Our generally used arrangement today includes two systems of air conduits, one for supply, the other for evacuation. A second pair of conduits supply and return a chilled fluid, usually water, to extract heat from circulated air as local areas demand; a third pair of conduits supplies and returns a second fluid to add heat to the circulated air as local requirements demand. The last two pairs of conduits are sometimes combined and arranged to carry warm or cold fluids alternately, depending on the general temperature out of doors. While this reduces the webs through the building from six to four and, of course, is done to reduce cost, such an arrangement has not been very satisfactory. It involves additional heat exchangers, and while it is satisfactory in either hot or cold seasons it has many drawbacks in the intermediate fall and spring periods. With this method there is required an additional network, a system of drains to carry off condensed moisture from the local conditioned spaces. This makes a total of either five or seven building networks, either three or five of which are pipes carrying water or steam, subject to maintenance of specialties, corrosion problems, and requiring space otherwise usable.

An air conditioning system using one fluid, air, which is essential in any system, and consisting of a maximum of three conduit networks, is a step forward in simplifi-

cation and provides a reduction in maintenance and repair problems. To reduce space requirements, more study should be given to higher velocities, approaching those of steam in normal heating systems, refinement of current practice in the design of conduits, the elimination of as many as possible of the awkward steps now used, and the elimination of expendable apparatus.

Reduce Wasted Space

There is another network in the building which requires further analysis. I refer to the steel web of columns and beams which holds the structure together. This part will require early and complete cooperation between the architect, structural designer and mechanical engineer. It is not unusual to find a building with horizontal beams and vertical columns in which the actual area occupied by steel is only 10 per cent or less of the total area of the beams or column. For example, I recently checked some architectural and structural drawings of a large office building and found that a column 20 inches square or 400 square inches of floor area had as its core a steel member with a total area of 22 sq in. As this occurred every 20 ft in both directions, proper utilization of this wasted space would have provided more than adequate room for a complete system of air distributing and recirculating conduits. By proper study and a functional redesign of steel, I feel that a substantial reduction in overall cost (including more usable space) can be achieved. As long ago as 1930, a research building was designed and built with hollow steel columns which were used for supply and return air shafts. More recently, the same basic idea has been used, but never, in my opinion, as completely as it should have been.

Controls

The third phase of the general problem relates to flexibility and control of local atmospheric conditions. Our present method is to add still another web through the building. This one is either electric wiring or small compressed air piping for providing power to operate controllers which regulate temperature and relative humidity. This is the phase which directly affects the occupant for whom the entire system is installed. Again there is a basic cost which permeates the entire structure, and there is an all-pervading maintenance problem which increases with age. This arrangement interconnects all thermostatic stations which in the nature of things should not be interrelated at all. Each one should be capable of independent setting to satisfy the desires of the individual in the local area.

Thermostats should be capable of readjustment and manipulation or relocation without the necessity of major labor expense each time they are changed. Automatic control systems seldom require any appreciable amount of power to actuate the controlling mechanisms. To reduce cost, therefore, and to add to the flexibility the thermostats should be self-contained and derive their motivating power from some always immediate source. Such sources of energy could be the energy (pressure) in the main air circulating system, the lighting system (by reconversion of unused light rays to motive energy), solar radiation, or even radio transmitted power. All such sources would be locally available without a network of interconnecting wires or pipes.

Bell Laboratories has recently announced the development of a direct battery actuated by solar radiation. This opens a wide area of investigation and speculation, not only for minor controls but for possible accumulation to operate major parts of the conditioning system. This discussion has not neglected, but eliminated for lack of space, discussion of such outlying principles as the heat pump, solar radiation absorption systems, panel cooling and heating, and various other phases of the air conditioning family.

Too often a building is generally designed by the architect and structural engineer before the mechanical engineer has a chance to arrange the air conditioning system. As a consequence too many compromises are necessary to squeeze the mechanical equipment into adequate space. I think it is essential that all three designers work from the very beginning to incorporate all the economies and flexibilities possible. An air conditioning system is no longer a postage stamp to be stuck on later. It is integral with and a part of the basic structure.

Filters for Radioactive Dusts and Vapors

Invisible, radioactive dust and vapors are captured by a fiberglass filter before they can leave laboratories. One of the AEC-owned installations that uses fiberglass filters as a first line of defense against the spread of radioactive contamination is the giant Hanford plutonium plant in southeastern Washington, operated by the General Electric company for the government.

John F. Gifford, a GE engineer, who supervises the company's Equipment Design unit at Hanford, told engineers and scientists about "Fiberglass Air Filters for 'Hot' Laboratories" at the third information meeting on "hot" laboratories at the Brookhaven National Laboratory in Upton, N. Y. The term "hot" laboratories refers to those working with radioactive materials.

At Hanford, according to Gifford, three sizes of disposable fiberglass filters have been used over the past three years for filtration of exhaust air from individual hoods and glove boxes (specialized equipment inside of which research work with radiation materials is carried on). These filters were designed primarily for disposability and low cost. No bolts or gaskets are used and the equipment is designed to provide the special advantage of quick handling.

A filter is installed by pressing its face over the exhaust duct. Removal can be done with tongs. This is a great advantage—the bulk of the airborne contamination is stopped in a small, easily removed package close to the source, Gifford said.

"The filtering efficiency of the three types used at Hanford range from 70 to 99.9 percent," Gifford continued. "The life of the filters is usually around a year, although some have been used longer and some, as in one used for sandblasting operations, have lasted only a few weeks."

Theoretically Required Exhaust Rates for Dust Control in Bulk Material Handling Systems

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It is well known that the required rate of exhaust from an enclosure handling bulk materials is often dependent upon the rate at which entrained air is pumped into the enclosure by motion of the individual particles of material. Many authorities (1), (2), (3), (4)[1] have reviewed the important fact that each individual particle moving through air tends to drag air with it. In preparation of a book (5) on the principles of industrial ventilation, the writer undertook to examine the nature of the phenomenon and to analyze the energy relationships involved. The resulting concepts are set forth in the present article.[2]

A PARTICLE in motion is subject to the resisting force due to air drag, the magnitude of which has been thoroughly explored and is a well established section of engineering information (6). A knowledge of the particle velocity permits calculation of the resisting force which in turn permits one to compute the power represented thereby, and from a knowledge of the total number of particles in a stream, the total power. Such a system may be likened to those depicted in Figs. 1 and 2.

If we assume that all of the power is devoted to the acceleration of portions of the surrounding atmosphere to a velocity which can be inferred by the dimensions of a particular system (Fig. 3), a basis is provided for describing the theoretical maximum rate of air motion. In industrial ventilation the following expression is routinely employed to describe the relationship between air flow, resistance and horsepower:

$$\text{H.P.} = \frac{qh}{6360}$$

where q is air flow in cfm, h is resistance in inches w.g., and the constant in the denominator includes the factor 33,000 ft-lb per minute and a factor for transformation of pressure units from pounds per square foot to inches of water column.

Consider now a continuous stream of falling particles

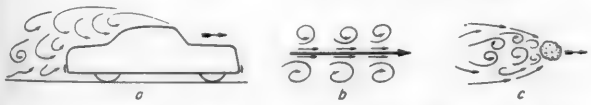

Fig. 1. The turbulent air currents behind any moving body have a net forward component.

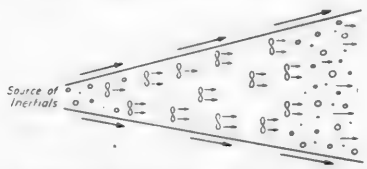

Fig. 2. Each separate individual in a stream of moving particles contributes to forward air motion. The system might be likened to myriads of miniature fans.

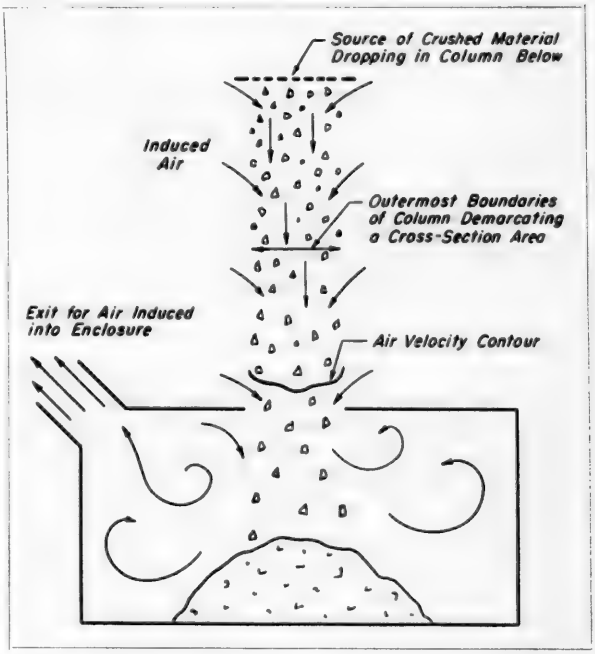
Source of Crushed Material Dropping in Column Below
Induced Air
Outermost Boundaries of Column Demarcating a Cross-Section Area
Exit for Air Induced into Enclosure
Air Velocity Contour

Fig. 3. A stream of crushed material falling into a bin, illustrating dimensions of air induction.

(Fig. 3), trajectories of which, taken in the aggregate, comprise a definite cross-section flow area, A' in square feet. This area may be defined by the pathways of the outermost particles in an unenclosed stream, or by the walls of an enclosing chute. Let v represent the average velocity in fpm of induced air in any selected plane area. The corresponding velocity head in inches w.g. will be $h_v = (v/4005)^2$ which, when substituted in the power equation, gives:

$$\text{H.P.} = \frac{q}{6360}\left(\frac{V}{4005}\right)^2$$

When for v we substitute the equivalent q/A' and rearrange the terms, the following expression results:

$$q^3 = (\text{H. P.})\ (A')^2 \times 10^{11}$$

If one could estimate the value of power (H. P.) in any instance, this relationship would provide a basis for estimating a magnitude of induced air flow which cannot be exceeded. As will be pointed out later, the simplifying assumptions implicit in this development indicate that in practice the value must frequently be much less than this.

[1] Numbers in parentheses refer to items in bibliography.

[2] Both this article and a paper presented at a meeting of American Industrial Hygiene Association, Chicago, Illinois, April 29, 1954, are based on chapters appearing in reference (5), to be published this year by The Industrial Press.

Power Generated by Falling Particles

The differential power dP generated by a particle in motion is:

$$dP = F_R du$$

where F_R is the magnitude of air drag and du is the differential change in velocity (Fig. 4). The value of F_R

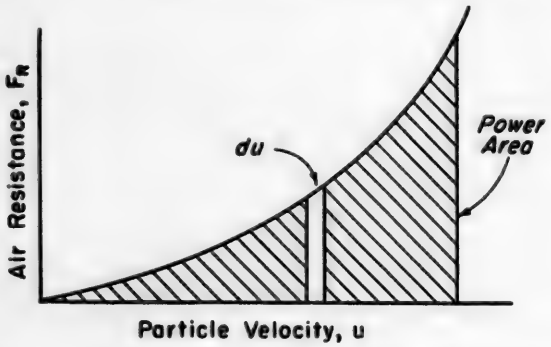

Fig. 4. Curve illustrating relations between air resistance, particle velocity and power.

must be represented by three different expressions according to whether the motion is turbulent, streamline, or intermediate. In the present discussion, we shall develop expressions only for the condition of turbulent flow. Reference (5) covers other conditions of motion.

One pound of material in the falling column at some particular location where the velocity is u in feet per second (a value corresponding to turbulent motion) will generate power in accordance with the following expression:

$$\text{H.P. per lb} = \int_{u_o}^{u} \left(\frac{0.44\rho A u^2}{2g}\right)\left(\frac{6}{\pi D^3 (62.4) z}\right)\left(\frac{1}{550}\right) du$$

where ρ is density of air, lb per cu ft; A is projected area of a single particle, sq ft; D is particle diameter, ft; z is specific gravity of particle (water = 1). The first group of terms is the resisting force, F_R, or drag of air in pounds per particle; the second group describes the number of spherical particles per pound of material; the third term converts to units of horsepower. Integration between suitable limits of velocity and changing the units of particle diameter to microns, gives:

$$\text{H.P. per lb} = \frac{6.92 \times 10^{-3}}{z d_m} \int_{u_{500}}^{u} u^2 du$$

$$= \frac{6.92 \times 10^{-3}}{3 z d_m} (u^3 - u_{500}{}^3)$$

The lower limit of the integration u_{500} represents the velocity where the intermediate flow relationship ends and the turbulent flow begins (a rather arbitrary point since there is no sharp transition between the two).

It is desirable for practical reasons to replace the velocity terms by distance terms. It is possible to compute the true relationship but no simple equation describes it, and in the present development we employ the relationship $u = \sqrt{2gs}$, for the sake of simplicity, accepting the error thereby entailed. The magnitude of this error is not great in the final result because of the cube root relationship between power and air flow and is, moreover, on the conservative side. This substitution results in the following expression:

$$\text{H.P. per lb} = \frac{6.92}{3} \frac{(2g)^{3/2} \times 10^{-3}}{z d_m} (s^{3/2} - s_{500}{}^{3/2})$$

where s is in feet from the point of zero velocity to the point of reading and s_{500} is the distance from zero velocity to the point where turbulent velocity begins.

This represents the power in a one-pound longitudinal slice of the stream and must, therefore, be multiplied by the total weight of material in the entire column. Letting the total weight in pounds be N, and R represent the rate of flow of solid material in pounds per second, the total column weight is given by:

$$N = \int_{s_{500}}^{s} \frac{R ds}{u} = \frac{R}{\sqrt{2g}} \int_{s_{500}}^{s} \frac{ds}{s^{1/2}}$$

$$= \frac{2R}{8.03} (s^{1/2} - s_{500}{}^{1/2})$$

in which we assign to velocity, u, the same simplified relationship as before. The product of the expression for H. P. per lb. and the above equation for total pounds within the column, leads to the following equation describing total horsepower generated by the entire column:

$$\text{Total H.P.} = 0.29 \frac{R}{z d_m} (s^{3/2} - s_{500}{}^{3/2})(s^{1/2} - s_{500}{}^{1/2})$$

where, as is usually true, the portion of travel in the preceding zone of intermediate motion is relatively small(i. e., s_{500} is small compared to s), we can neglect the second term in each binomial, then the equation reduces to:

$$\text{Total H.P.} = \frac{0.29 R s^2}{z d_m}$$

Practical Limitations of the Theory

Some of the limitations of the theory have been indicated in the assumptions given in the preceding development. Some of the others are as follows:

We assume that each particle acts independently of its fellows, which supposes that they are completely separated from each other. This is seldom true. More often than not a stream of material falls in a column as a nearly compact mass that is only partly dispersed or aerated.

Another departure from theory is evident from a consideration of the widely varying falling velocities of various sizes of particles in an heterogeneous mixture of crushed material. To what extent do the particles of smaller velocity contribute to the air motion process in relation to that of larger particles hurtling downward through the mass at a velocity several times that of the smaller particles? Other limitations will occur to the reader.

Analysis of Water Drop Tests

A portion of the data on air induction by drops of water falling distances up to five or six feet as reported by Pring, Knudsen, and Dennis(4) are shown in the

last column of Table 1. The two adjoining columns are the values calculated according to theory. The various pertinent dimensions of their tests indicate the air drag pattern to be that of intermediate motion, for which we have derived (5) the expression:

$$\text{Total H.P.}_{\text{(intermediate zone)}} = \frac{48Rs^{1.7}}{zd_m{}^{1.6}}$$

which, in conjunction with the earlier equation relating q^3 with H. P. and A', permitted calculation of the air flow values given in the table. Presentation of two values stems from some uncertainty as to the appropriate value of falling distance s. The minimum is that between the droplet source and the rim of the tank, and the maximum is taken as the distance from the droplet source to the bottom of the tank. The fact that the theory is in approximate agreement with the experimental data is cause for gratification.

Air Induction Laws

It is possible to formulate some general laws of air motion analogous to the well-known fan laws by suitable consideration of the relationships previously presented. They may be summarized as follows:

The maximum theoretical rate of air induction due to a stream of falling particles in turbulent motion is proportional to:

(1) The cube root of the tonnage rate of solid flow.
(2) The cube root of specific gravity of solids.
(3) The cube root of particle diameter.
(4) The ⅔ power of solids stream cross-sectional area.
(5) The ⅔ power of falling distance.

TABLE 1.—COMPARISON BETWEEN OBSERVED AND CALCULATED AIR FLOW INDUCED BY FALLING WATER DROPLETS

Test No.	Falling Distance to Tank Rim, Ft	Calculated Air Flow Based on Max. & Min. Falling Dist.		Experimentally Determined Air Flow, CFM
		Max., CFM	Min., CFM	
16	2.5	25	11	5
17	3.0	28	16	17
101	3.0	28	16	12
18	3.5	30	20	22
19	4.0	31	22	27
102	4.0	31	22	26
20	4.5	34	25	34
21	5.0	38	29	38
103	5.0	38	29	35
22	5.5	40	32	46
23	6.0	41	34	49
37	6.0	70	57	64

For practical purposes turbulent flow may be regarded as confined to particles larger than about two millimeters, and to columns in which the falling distance considerably exceeds two or three feet.

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(4) Pring, R. T., Knudsen, J. F., and Dennis, R., Design of Exhaust Ventilation for Solid Materials Handling *Ind. Eng. Chem., 41*, 2442-2450 (1949).
(5) Hemeon, W. C. L., *Plant and Process Ventilation*, The Industrial Press, 148 Lafayette St., New York 13, N. Y.
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Radiant Heat Ideal For Zoo Snakes

You won't be able to keep a snake in the grass once he's seen New York's Bronx Zoo—thanks to automatically controlled radiant heat.

The Zoo's 500 snakes, alligators, crocodiles, lizards, and turtles, in the new reptile house opened recently, will enjoy temperatures exactly to their liking in cages and artificial ponds.

Take a rattler, for example, a fellow who's sure to suffer all extremes of temperature in the wilds of North America. Now, every day of the year, he'll bask or wriggle on a panel heated to 80F—the one temperature he enjoys the best. A south Asia cobra in a near-by cage will enjoy 85F, the temperature he likes best.

The new approach to snake comfort is the brainchild of Dr. James A. Oliver, curator of reptiles at the Zoo. Working with Harry H. Bond, consulting heating engineer, and Minneapolis-Honeywell engineers, he has come up with one of the neatest tricks in zoo management. By grading the panel heating up to the front of the cages to the exact temperature preferred by the snakes, he keeps the creatures at the location where they can best show off to the public.

Once before, radiant heating was used in zoo snake cages, but without controls. The inevitable happened. One day the panels got too hot and the snakes were literally fried.

Naturally Dr. Oliver wants to prevent this. But he wants a lot more from controlled radiant heat. He believes that reptiles—like humans—will be healthier and act more normally if the temperature suits them. He is embarking on a controlled experiment to determine the exact degree that each snake prefers in temperature. In the meantime, he has set cage temperatures based on the best scientific studies of snakes in all parts of the world.

To meet Dr. Oliver's requirements, Mr. Bond specified two or three coils in the front of cages. These generate enough heat to keep the rest of the cage warm but not enough heat to encourage a snake to slink off to the rear of the cage.

To control the panel heating system, Honeywell engineers mounted capillary tubes near the surface of the panels. The tubes connect with thermostats mounted outside the cage. The thermostats, in turn, control a pneumatic valve to the coils.

So that reptile house keepers do not have to read temperatures at each cage, Honeywell Industrial Division engineers have provided an electronic recorder at a central location. An attendant can check the temperatures in any cage by pushing a button opposite a numbered listing of the cage. Posted on the recorder panel is the desired temperature for each cage.

Summer Degree-Days

A CORRELATION between consumption of electrical energy for summer air conditioning and temperature data similar to that determined years ago between fuel consumption for heating, and known as degree-day, has long been sought.

The latest development in this search is that reported by three Carrier engineers in a paper presented before the ASHVE summer meeting in Swampscott last month.* The paper describes in detail the method used by the authors in determining the base for these "summer" degree-days, which they found to be 70 deg. The number of summer degree-days on a given day is the average temperature for that day minus 70 deg. There are no negative degree-days, so that the totals are made up only of days when the average temperature is over 70 deg. If the average temperature on a day is 82 deg., there are 12 "summer" degree-days on that day.

The authors have analyzed data from cooling systems in eleven residences, two each in Atlanta, Washington and New Orleans, three in Dallas, one in Houston, and one in Syracuse. The correlation applies only to residences.

The authors conclude that costs of electrical energy for summer cooling of residences based on use of this unit can be computed within plus or minus 8% or $10 whichever is greater.

The authors of the paper derived the equation for predicting the number of hours the plant will operate as

$$T = 24 \times \frac{H}{C} \times \frac{D}{t_m - 70}$$

where T is the number of hours the plant operates during a period, H is the average hourly cooling load over the period in Btu, C is the total cooling capacity of the equipment in Btu per hour, D is the number of summer degree-days during the period using the base 70 deg., and t_m is the design dry bulb temperature of the system less one half the daily range of average dry bulb temperatures during July, August and September.

Since the author's paper did not include data on the number of summer degree-days for various cities, the accompanying table has been prepared to give some idea of the loads involved. These figures are normals; that is, they have been calculated from normal dry bulb temperature data *on a daily basis*. For any given period, the actual numbers can fluctuate sharply, and since the number of summer degree-days is not too large in any city, the deviation can be and probably will be, much larger from year to year in percentage than is the case with heating degree-days. The figures in the table do purport to show the average relative electrical load for residential cooling systems in various cities.

Cities for which data were available but for which there are no *normal* summer degree-days are: Alpena, Mich., Baker, Ore., Block Island, R. I., Cheyenne, Wyo., Concord, N. H., Duluth, Minn., Eastport, Me., Escanaba, Mich., Eureka, Calif., Grand Haven, Mich., Havre, Mont., Helena, Mont., Houghton, Mich., Kalispell, Mont., Lander, Wyo., Marquette, Mich., Moorhead, Minn., Nantucket, Mass., Northfield, Vt., North Head, Wash., Port Huron, Mich., Portland, Me., Portland, Ore., Roseburg, Ore., San Diego, Calif., San Francisco, Calif., San Luis Obispo, Calif., Santa Fe, N. M., Sault Ste. Marie, Mich., Seattle, Wash., Tacoma, Wash., Williston, N. D.

*The Operating Cost of Residential Cooling Equipment, by S. F. Gilman, L. A. Hall, and E. P. Palmatier, all of the Research Dept., Carrier Corp., of which Mr. Palmatier is Director.

NORMAL NUMBER OF SUMMER DEGREE-DAYS (70 DEG. BASE) FOR 127 U. S. CITIES

City	May	June	July	Aug	Sept	Oct	Total
Abilene, Tex.	70	276	397	372	159	1	1275
Albany, N. Y.	..	3	81	35	..	..	119
Amarillo, Tex.	..	88	211	177	24	..	500
Atlanta, Ga.	30	180	251	217	76	..	754
Atlantic City, N. J.	..	..	66	78	..	..	144
Augusta, Ga.	80	261	350	322	159	2	1174
Baltimore, Md.	..	82	223	171	13	..	489
Binghamton, N. Y.	..	..	5	..	..	..	5
Birmingham, Ala.	51	237	316	285	144	1	1034
Bismarck, N. D.	..	..	7	..	..	..	7
Boise, Idaho	..	..	90	64	..	..	154
Boston, Mass.	..	..	53	18	..	..	71
Brownsville, Tex.	267	372	422	431	318	152	2080[1]
Buffalo, N. Y.	..	..	5	1	..	..	6
Burlington, Vt.	..	..	12	..	..	..	12
Cairo, Ill.	16	189	298	242	60	..	805
Charles City, Iowa	..	..	71	14	..	..	85
Charleston, S. C.	88	267	353	341	198	13	1260
Charlotte, N. C.	17	165	260	220	57	..	719
Chattanooga, Tenn.	15	162	260	233	72	..	742
Chicago, Ill.	..	9	121	87	..	..	217
Cincinnati, Ohio	..	46	158	112	3	..	319
Cleveland, Ohio	..	..	43	15	..	..	58
Columbia, Mo.	..	86	214	174	13	..	487
Columbia, S. C.	67	243	28	298	135	..	771
Columbus, Ohio	..	41	152	93	..	..	286
Concordia, Kan.	..	94	248	202	18	..	562
Corpus Christi, Tex.	192	330	394	388	291	101	1730[2]
Davenport, Iowa	..	36	164	96	..	..	296
Dayton, Ohio	..	53	167	105	1	..	326
Denver, Colo.	..	..	68	32	..	..	100
Des Moines, Iowa	..	39	167	96	..	..	302

NORMAL NUMBER OF SUMMER DEGREE-DAYS (70 DEG. BASE) FOR 127 U. S. CITIES

City	May	June	July	Aug	Sept	Oct	Total
Detroit, Mich.	..	2	65	25	..	..	92
Dodge City, Kan.	..	81	260	239	35	..	615
Dubuque, Iowa	..	19	127	58	..	..	204
Elkins, W. Va.	..	..	12	2	..	..	14
El Paso, Tex.	59	288	344	285	118	..	1094
Erie, Pa.	..	..	32	10	..	..	42
Evansville, Ind.	4	153	276	229	45	..	707
Fort Smith, Ark.	27	225	357	326	122	..	1057
Fort Worth, Tex.	78	297	422	403	207	9	1416
Fresno, Calif.	4	174	375	332	103	..	988
Galveston, Tex.	149	321	415	403	303	92	1690[3]
Grand Junction, Colo.	..	64	239	167	6	..	476
Grand Rapids, Mich.	..	4	71	15	..	..	90
Green Bay, Wis.	..	..	5	..	..	..	5
Greenville, S. C.	4	123	214	180	40	..	561
Hannibal, Mo.	..	79	211	155	10	..	455
Harrisburg, Pa.	..	33	149	78	..	..	260
Hatteras, N. C.	16	168	254	248	135	2	823
Houston, Tex.	171	342	425	409	270	46	1677[4]
Huron, S. D.	..	..	56	13	..	..	69
Independence, Calif	..	78	251	189	12	..	530
Indianapolis, Ind.	..	56	177	115	2	..	350
Ithaca, N. Y.	..	..	18	3	..	..	21
Jacksonville, Fla.	155	297	375	363	249	54	1577[5]
Kansas City, Mo.	..	109	251	205	20	..	585
Keokuk, Iowa	..	77	214	155	8	..	454
Key West, Fla.	282	357	419	419	366	282	2536[6]
Knoxville, Tenn.	3	120	220	192	41	..	576
La Crosse, Wis.	..	7	87	24	..	..	118
Lansing, Mich.	..	..	27	3	..	..	30
Lewiston, Idaho	..	1	124	89	..	..	214
Lexington, Ky.	..	69	183	140	11	..	403
Lincoln, Neb.	..	57	202	136	3	..	398
Little Rock, Ark.	36	222	338	304	123	..	1023
Los Angeles, Calif.	..	..	14	34	1	..	49
Louisville, Ky.	3	141	267	217	41	..	669
Lynchburg, Va.	5	138	233	174	19	..	569
Macon, Ga.	75	267	347	307	144	..	1140
Madison, Wis.	..	2	65	17	..	..	84
Memphis, Tenn.	42	228	22	291	109	..	692
Meridian, Miss.	55	243	312	295	135	..	1040
Milwaukee, Wis.	..	..	10	5	..	..	15
Minneapolis, Minn.	..	4	71	22	..	..	97
Mobile, Ala.	132	309	353	341	243	34	1412
Modena, Utah	..	..	26	10	..	..	36
Montgomery, Ala.	106	288	363	335	189	8	1289
Nashville, Tenn.	12	168	282	242	66	..	770
New Haven, Conn.	..	..	56	24	..	..	80
New Orleans, La.	167	318	384	378	276	57	1589[7]
New York, N. Y.	..	10	118	96	1	..	225
Norfolk, Va.	..	132	270	229	57	..	689
North Platte, Neb.	..	3	90	39	..	..	132
Oklahoma City, Okla.	7	180	329	301	90	..	907
Omaha, Neb.	..	61	208	136	3	..	408
Oswego, N. Y.	..	..	17	2	..	..	19
Palestine, Tex.	84	270	378	366	210	12	1320
Parkersburg, W. Va.	..	51	167	121	5	..	344
Pensacola, Fla.	121	279	341	338	240	38	1357
Philadelphia, Pa.	..	52	192	149	8	..	401
Phoenix, Ariz.	155	435	614	574	381	58	2218[8]
Pierre, S. D.	..	18	164	86	..	..	268
Pittsburgh, Pa.	..	37	143	90	..	..	270
Pocatello, Idaho	..	..	40	19	..	..	59
Pueblo, Colo.	..	22	130	84	..	..	236
Raleigh, N. C.	13	171	273	217	49	..	723
Rapid City, S. D.	..	..	35	14	..	..	49
Red. Bluff, Calif.	1	144	335	301	95	..	876
Richmond, Va.	1	123	264	202	43	..	633
Rochester, N. Y.	..	..	24	6	..	..	30
Sacramento, Calif.	..	12	99	90	10	..	211
Saginaw, Mich.	..	..	34	4	..	..	38
St. Louis, Mo.	4	144	267	286	38	..	739
St. Paul, Mich.	..	1	65	15	..	..	81
Salt Lake City, Utah	..	10	177	140	..	..	327
San Antonio, Tex.	158	330	428	419	270	49	1665[9]
Sandusky, Ohio	..	13	105	57	..	..	175
Savannah, Ga.	105	270	357	332	186	13	1263
Scranton, Pa.	..	2	53	14	..	..	69
Shreveport, La.	112	321	409	372	207	8	1429
Sioux City, Iowa	..	21	133	67	..	..	221
Spokane, Wash.	..	..	1	1	..	..	2
Springfield, Ill.	..	70	202	140	7	..	419
Springfield, Mo.	..	78	211	177	17	..	483
Tampa, Fla.	189	306	347	357	297	133	1661[10]

NORMAL NUMBER OF SUMMER DEGREE-DAYS (70 DEG. BASE) FOR 127 U. S. CITIES

City	May	June	July	Aug	Sept	Oct	Total
Toledo, Ohio	..	11	99	44	..	..	154
Topeka, Kan.	..	108	242	192	21	..	563
Valentine, Neb.	..	7	115	59	..	..	181
Vicksburg, Miss.	91	270	350	335	189	7	1242
Walla Walla, Wash.	..	1	124	87	..	..	212
Washington, D. C.	..	66	210	155	10	..	440
Wichita, Kan.	..	132	291	257	50	..	730
Wilmington, N. C.	44	204	282	236	93	..	859
Winnemucca, Nev.	..	..	31	18	..	..	49
Yankton, S. D.	..	16	130	65	..	..	211
Yuma, Ariz.	192	441	645	632	51	110	2085[11]

[1]Total for Brownsville includes 4 in March, 111 in April, and 3 in November. [2]Total for Corpus Christi includes 34 in April. [3]Total for Galveston includes 7 in April. [4]Total for Houston includes 13 in April. [5]Total for Jacksonville includes 84 in April. [6]Total for Key West includes 15 in February, 81 in March, 171 in April, 129 in November, and 15 in December. [7]Total for New Orleans includes 9 in April. [8]Total for Phoenix includes 1 in April. [9]Total for San Antonio includes 11 in April. [10]Total for Tampa includes 32 in April. [11]Total for Yuma includes 14 in April.

A Time-Proportional Electronic Thermostat

A versatile electronic thermostat is now in use at the National Bureau of Standards as a general-purpose temperature controller for a variety of applications. Developed by F. A. Ransom of the NBS electronic instrumentation laboratory, the instrument is designed for flexibility and high sensitivity and provides precision temperature control over a wide range of temperature and power requirements.

The device features such advantages as (1) no appreciable dead zone; (2) the sensitivity may be raised very high without objectionable loss of stability, reducing the deviation from the control point to a minimum with any load changes; (3) capability of handling power requirements ranging from milliwatts to kilowatts for control; (4) the use of sensing elements which may be a resistance thermometer or a thermistor connected in a bridge circuit, or a thermocouple connected to a chopper circuit; and (5) the use of standard commercial components. The thermostat utilizes a principle originally described by M. Gouy of France, in which the power supplied to the heating element is switched on and off in a regular cycle, but the fraction of the cycle during which the power remains on is proportional to the deviation from the desired temperature.

The temperature sensing element—usually a resistance thermometer or thermistor—is connected in one arm of an alternating-current bridge. The adjacent arm of the bridge is a variable resistor adjustable to the desired temperature control point. A 164-cps oscillator energizes the bridge and also supplies synchronizing voltage to a twin-diode synchronous detector. When the actual temperature at the sensing element deviates from the control temperature, the resulting bridge error signal is amplified and applied to the center leg of the synchronous detector. The resulting current in the center leg is determined by the amplitude and phase of the error voltage, being zero when the error voltage is zero.

Also applied to the detector, in series with the error voltage, is a voltage from a sawtooth oscillator. The result is that the output of the detector consists of a sawtooth voltage that operates about a reference level which varies with the error voltage. This detector output is applied to a Schmitt trigger circuit, which in turn actuates a relay that switches the power applied to the control heater.

With this arrangement the sawtooth voltage applied to the detector can be adjusted so that, when the temperature deviation and thus the error voltage are zero, the control relay applies power to the heater 50% of the time. Any temperature deviation from the control point then alters the proportion of the "duty cycle" during which power is applied to the heater; this proportion varies above or below 50% depending on the magnitude and direction of the temperature deviation. Large temperature deviations, beyond the proportional control range for which the instrument is set, result in the heater power being either on or off continuously—depending on the direction of the deviation—until the temperature is again brought within the proportional range. The duty cycle, determined by the frequency of the sawtooth oscillator, is designed to be adjustable over a range of about 5 to 15 seconds to meet the needs of any process.

Since the controller is of the time-proportioning type, its time of response to a temperature change is slightly longer than that of other types of controllers. Also, if the total power is switched in the control of processes having small thermal capacities and short thermal time lags, the temperature may cycle about the control point. In such cases the magnitude of the cycling can easily be minimized by supplying a portion of the required power continuously and switching only the power needed to compensate for any load changes in the process.

This thermostat has been used successfully to control a number of processes at NBS, and experience shows that its sensitivity, stability, and flexibility make it valuable for many laboratory applications requiring precision temperature regulation. In a typical NBS application the thermostat has for many months held standard electric cells, immersed in an oil bath, to a controlled temperature of 28° within ±0.001°C.

Another use of the instrument has been in a small electrical furnace. The typical small heated-air oven is ordinarily difficult to control because of its low thermal inertia. Using the NBS thermostat, the temperature was maintained to within ±0.1°C over a range from 250° to 450°C.

Centrifugal Pump Casings

IGOR J. KARASSIK and ROY CARTER

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This is the second of a series of articles on various factors affecting centrifugal pump selection and application. The authors extend last month's discussion of pump types with a detailed account of the shapes, applications, and terminology of pump casings.

BECAUSE the main function of the pump casing is to convert the velocity energy imparted to the liquid by the impeller into useful pressure energy by reducing the velocity of the liquid discharged from the impeller, the first natural classification of centrifugal pump casings in on the basis of the type of this energy conversion. Hence, casings may be of either (a) volute type or (b) diffuser or turbine type.

The volute casing (Fig. 1) is so-named for its spiral shape. It increases in area over the entire 360° surrounding the impeller and is then flared out to the final required discharge opening. The volute proper and the discharge nozzle portion of the casing are divided by a wall which is called the tongue of the volute or sometimes, the cut-water.

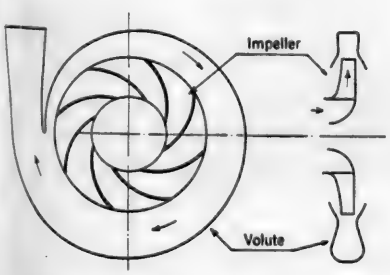
The turbine pump (Fig. 2) receives its name from the diffusion vanes in a concentric casing which make it resemble conventional water-turbine construction. It is more commonly called a diffuser type pump today. At the present time diffuser type pumps are seldom used for single stage pump construction, except for applications such as propeller type pumps where axial or mixed-flow impellers are used. It would not be practical in such designs to use a volute casing and the impeller is therefore enclosed in a casing resembling a pipe. While diffuser vanes usually are incorporated into this casing following the impeller, these vanes sometimes are omitted in extremely low head units. The major application of diffusion-vane pumps is in vertical turbine type pumps multistaged for higher head (Fig. 3). Another important application is for high pressure multistage horizontal pumps.

Because a volute is not symmetrically disposed around the impeller, there is an inequality in pressure distribution over the 360° of the volute. This sets up a hydraulic reaction perpendicular to the shaft which is magnified when the pump operates at reduced capacities. This reaction is called radial thrust. The magnitude of radial thrust is a function of the head, the impeller diameter, impeller width, casing and impeller design, and operating capacity with little, if any, thrust being developed in normal designs at point of maximum efficiency and with maximum radial thrust being developed at shut off. Unless a pump is to be operated at part capacities or over a wide head range, radial thrust rarely complicates the designer's problem. Some applications require operation over a wide range of capacity often with capacities approaching shut off and it is necessary to use a heavier shaft design or take means to reduce the radial thrust.

One means of combating the effect of radial thrust in volute pumps is the use of twin volutes, which are, in effect two half-capacity volutes, each taking the discharge from a 180° arc of the impeller. This construction is used fairly widely in high pressure multistage pumps in the medium capacity range. It is not as well applicable (nor necessary) in smaller sizes of single stage pumps because of the difficulty of obtaining satisfactory foundry castings and of the appreciable increase in frictional losses.

Fig. 1. (Below) Volute type centrifugal pump casing.

Fig. 2. (Right) Diffuser type centrifugal pump casing.



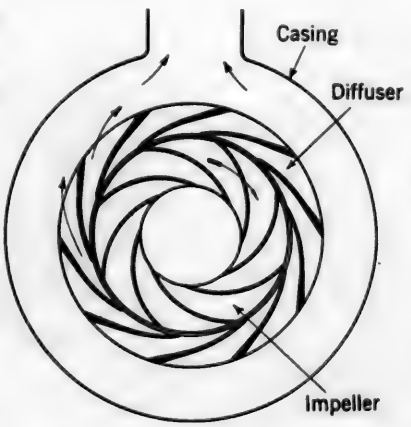
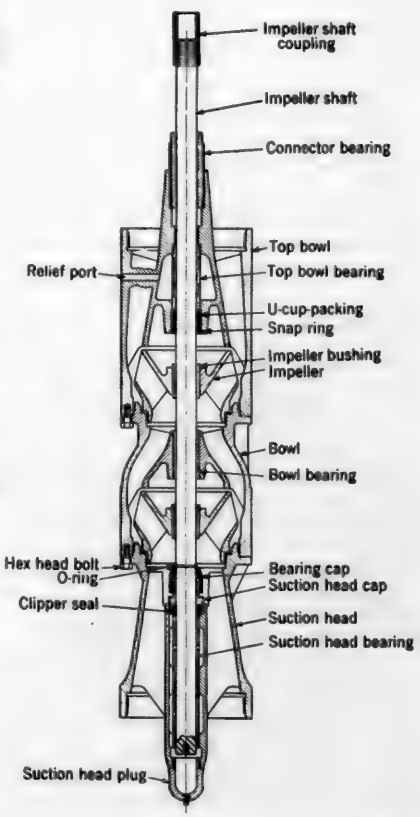


Fig. 3. (Right) Vertical turbine type pump with diffusion vanes.



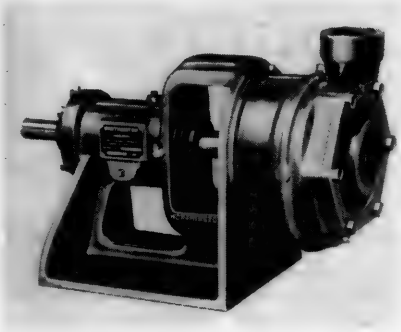
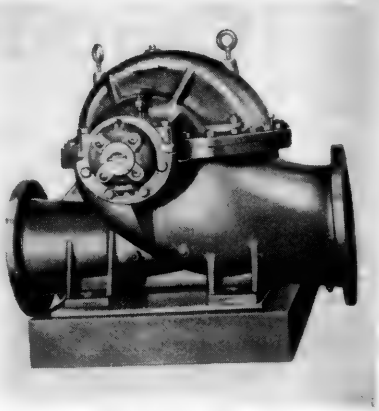


Fig. 4. (Left) Radially split casing end-suction single stage pump with overhung impeller.

Fig. 5. (Right) Axially split casing single stage pump, with side suction.



Nor is the twin-volute suitable for axially split double suction designs. The first objection arises from the fact that when the pumping installation requires a unit of large enough size to warrant the use of a twin volute, a vertical shaft, bottom suction construction will generally prove to be more economical. Another objection is that the conventional design of horizontal double suction pump has a horizontal discharge and its casing is split in the horizontal plane, the split casing coming approximately 90° from the tongue of the volute. This makes it necessary to have part of both volutes split by the joint, thus offering a serious manufacturing problem in matching the waterways of the two casing halves.

Solid and Split Casings

In centrifugal pump nomenclature, *solid casing* implies a design in which the discharge waterways leading to the discharge nozzle are all contained in one casing or fabricated piece. In order that the impeller may be introduced into such a casing, the latter has to have at least one side open. As the sidewalls surrounding the impeller are in reality part of the casing, a solid casing, strictly speaking, cannot be used and designs normally called solid casing are really radially split casing designs (Fig. 4).

The term *split casing* implies that the casing is made of two or more parts fastened together. The term *horizontally split* was devised to indicate the casing construction usually employed with horizontal shaft double suction pumps to show that the casing is divided by a horizontal plane through the shaft centerline or axis (Fig. 5). Engineers now prefer the term *axially split* for this type of construction. As both the suction and discharge nozzles are normally in one half of the casing, this construction permits the removal of the other half (upper half in the case of horizontal shaft pumps) for examination of the interior without disturbing the bearing or the piping.

Like its counterpart, *horizontally split*, the term *vertically split* is bad terminology. It is intended to refer to a casing which is split in a plane perpendicular to the axis of rotation. The term *radially split* is now being used by some designers to designate this type of construction.

End-Suction Pumps

As mentioned in the first article of this series, the end-suction, single stage pump is giving indications of becoming the most popular type of construction for the entire range of low and medium capacities and medium heads. It owes this popularity to the fact that it is inherently more economical and most readily adaptable to wide standardization.

Most end-suction single-stage pumps are made with one-piece or so-called solid casings. At least one side of the casing must be open so the impeller can be assembled in the pump, thus necessitating a cover for that side. If the cover is on the suction side. it contains the suction opening and forms the side wall of the casing. This cover is called the casing suction head.

Some designs of end-suction single-stage pumps with solid casings have casing suction heads for impeller removal, as in Fig. 6, others are made with stuffing box heads (Fig. 7), and still others have both casing suction heads and stuffing box heads (Fig. 8).

For general service, the end-suction single-stage pump design is extensively used for small pumps up to 4- and 5-inch discharge size, for the motor mounted type and for the so-called contractor types. In all of these types, the small size makes it feasible to cast the volute and one side integrally. The choice of whether the stuffing box side or the suction side is made integrally with the casing is usually determined by the general design of the pump with the general aim of obtaining the lowest possible cost. For larger pumps of this type especially those for special service, like sewage pumps, there is a demand for pumps of both rotations and a design with both a separate suction head and a separate stuffing box head permits utilizing the same casing for either rotation if the flanges on the two sides are made identical (Fig. 8). Furthermore, for this latter group there is a demand for vertical shaft pumps which can best be disassembled by removing the rotor and bearing assembly from the top of the casing, while in many of the horizontal applications of the pumps of the same line, the installation favors partial dismantling from the suction side. Thus such lines are more adaptable if made with both separate suction heads and stuffing box heads.

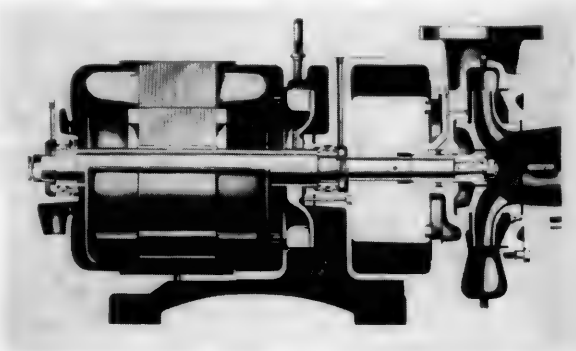


Fig. 6. End-suction pump with removable suction head. ..

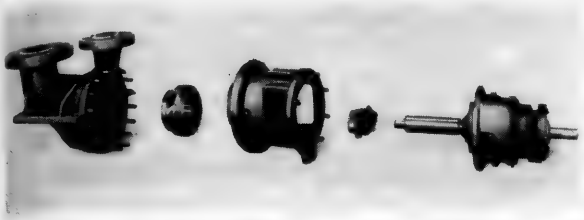


Fig. 7. End-suction pump with removable stuffing-box head.

For open impeller pumps intended to handle relatively clear liquids, the impeller rotates within close clearance of the pump casing or suction head, as in Fig. 7. When the service for which the pump is intended is more severe, a side plate is mounted within the casing to provide a renewable close clearance guide to the water flowing through the open impeller. One of the advantages derived from the use of of side-plates is that abrasion resistant material such as stainless steel may be used for the impeller and sideplate while the casing itself may be made of a less costly material.

Nozzle Locations

The discharge nozzle of end-suction single stage pumps is generally in a top vertical position (as in Figs. 4, 6, and 7), although other nozzle positions may be obtained in certain cases, such as top horizontal, bottom horizontal or bottom vertical discharge. Fig. 9 illustrates the flexibility which can be imparted to such a pump with regards to discharge nozzle location. However, sometimes the pump frame, bearing bracket or baseplate will interfere with the discharge flange, prohibiting a bottom horizontal or bottom vertical discharge nozzle position. In certain other cases, solid casings cannot be rotated for various nozzle positions because the seal connection on the stuffing box would be inaccessible.

Practically all double-suction horizontal shaft, axially split casing pumps have a side-discharge nozzle and either a side or a bottom-suction nozzle. When the suction nozzle is placed on the side of the pump casing with its axial centerline at right angles to the vertical centerline of the pump, as in Fig. 5, the pump is classified as a side suction pump. When its suction nozzle points vertically downward (Fig. 10), the pump is called a bottom suction pump. Single-stage bottom-suction pumps are rarely made in sizes below 10 discharge nozzle diameter.

Special nozzle positions can sometimes be provided for double suction axially split casing pumps in order to meet special piping arrangements as, for instance, a vertically split casing with bottom suction and top discharge in one

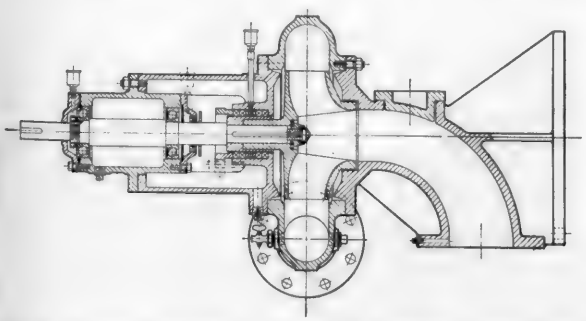


Fig. 8. Vertical end-suction pump with removable suction and stuffing box head.

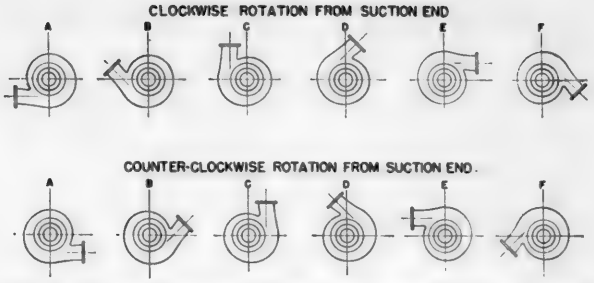


Fig. 9. Possible discharge nozzle locations for a solid casing end-suction pump.

half of the casing. Such special designs are generally more expensive and should be avoided.

Centrifugal Pump Rotation

Inasmuch as suction and discharge nozzle locations are intimately connected with the rotation selected for a given centrifugal pump, it is very important to understand the means used to define the direction of rotation.

According to the Hydraulic Institute Standards, rotation is clockwise or counter-clockwise when looking at the driven end of a horizontal pump or down on a vertical pump. Some manufacturers still designate rotation of a horizontal pump looking at its outboard end. Therefore, to avoid misunderstanding, rotation should always be qualified by the direction from which one looks at the pump.

Inboard and outboard ends are terms used with horizontal pumps only. Inboard end is the one closest to the driver, while the outboard end is the one farthest away. In the case of dual driven pumps, the terms lose their significance and are not used. To designate location of pump bearings inboard and outboard terminology is also used. In case of pumps having a bearing on both sides, the inboard bearing is that on the coupling or driver side while the outboard bearing is on the other side. For end suction pumps having both bearings on one side of the impeller, the bearing nearest the impeller is the inboard bearing while that nearest the coupling is the outboard bearing.

Except for end suction pumps, with integral heads on either side when separate casing patterns are required, any given centrifugal pump casing pattern may be arranged for either clockwise or counter-clockwise rotation.

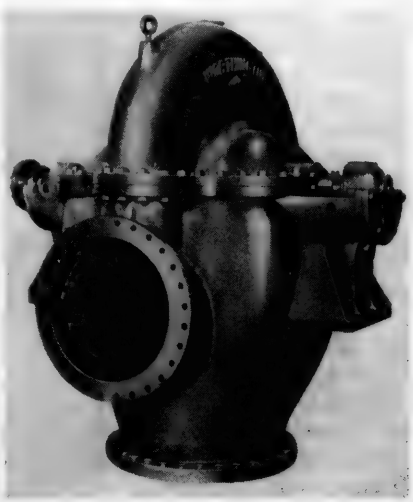


Fig. 10. Bottom-suction axially split casing single stage pump.

Casing Hand Holes

Casing hand holes are furnished primarily on pumps handling sewage and stringy materials which may become lodged on the suction vane edges of the impeller to provide access for cleaning out such material without dismantling the complete pump. On the end-suction type of pump used primarily for handling liquids of this type, hand holes with access to the suction side of the impellers are provided on the suction head or in the suction elbow. Hand holes are also provided on drainage, irrigation, circulating and supply pumps when foreign matter may become lodged in the waterways.

Special Operating Conditions

The majority of single stage centrifugal pumps are intended for service with moderate pressures and temperatures. As a result, it is the general practice of pump manufacturers to design a special line or lines of pumps intended for high operating pressures or unusual temperatures rather than to render their standard line unduly expensive by making it suitable for too wide a range of operating conditions.

When large capacity, medium high head service conditions require it, two single stage double suction pumps may be connected in series on one baseplate with a single driver. Such an arrangement is very common in water supply applications for heads of 250 to 400 feet. One type of series arrangement uses a double extended shaft motor in the middle, driving two pumps connected in series with interconnecting piping. In a second type, a standard motor is used, and one pump is then furnished with a double extended shaft.

Multistage Pump Casings

Both axially and radially split casings are used for multistage centrifugal pumps. The idea of splitting the casing in a plane parallel to the axis of rotation was introduced to promote accessibiltiy for inspection and repairs.

As long as the range of pressure stays within reasonable limits, say 1200 to 1400 psi, the axially split casing design retains marked advantages. However, when operating pressures exceed this range of values, it becomes impossible to design axially split casings so that they remain tight and the conditions are met with the so-called double casing type pump.

The basic principle of the double casing design consists in enclosing the working parts of a multistage centrifugal pump in an inner casing and in building a second solid casing around this inner casing. The space between the two casings is maintained at the discharge pressure of the last stage of the pump. The inner casing may be either axially split or radially split.

Next month—Impellers and Wearing Rings.

Choice of Systems for Hotel Air Conditioning

Sterling Nicholson, president of Nicholson, Inc., Durham, North Carolina, and Chrysler Airtemp's oldest dealer-distributor, outlined the various systems of air conditioning to North Carolina's hotel men meeting in Durham recently.

According to Mr. Nicholson, air conditioning in hotels costs from $300.00 to $1,200.00 per room, depending on the type used. All types cost about $15.00 per room per season to operate in North Carolina and produce from $100.00 to $200.00 extra revenue per room per season.

In addition, Mr. Nicholson cited his views on four types of installations.

Individual Room Air Conditioners: Mr. Nicholson said that he would lease rather than buy these units, if he were a hotel man. The advantages are: low initial cost; the building can be air conditioned room by room; individual room control of temperature; quick and easy installation; readily available from dealers, and low maintenance cost for five years (if you lease them, the company does maintenance).

However, Mr. Nicholson also listed some disadvantages for room air conditioner installations in hotels. He indicated that the hotel cannot get away from the outside appearance; electrical wiring is necessary; the room air conditioner cannot do an adequate job of winter heating; the window installation obstructs vision; there is a maintenance cost after five years (compressor); mechanics must enter the room to service the units; also, he said the operating costs were relatively high.

Packaged Unit System: This is at least a 25 year installation and the lowest-priced type of good air-conditioning. Use of a cooling tower is recommended.

Advantages of this system are: Relatively low initial cost; quick and easy installation, with furred ceilings; corridors act as return air ducts; the remainder of the building will be air conditioned if one unit fails; there is a fair degree of individual room control; and this system provides heating, cooling and ventilation through one set of ducts.

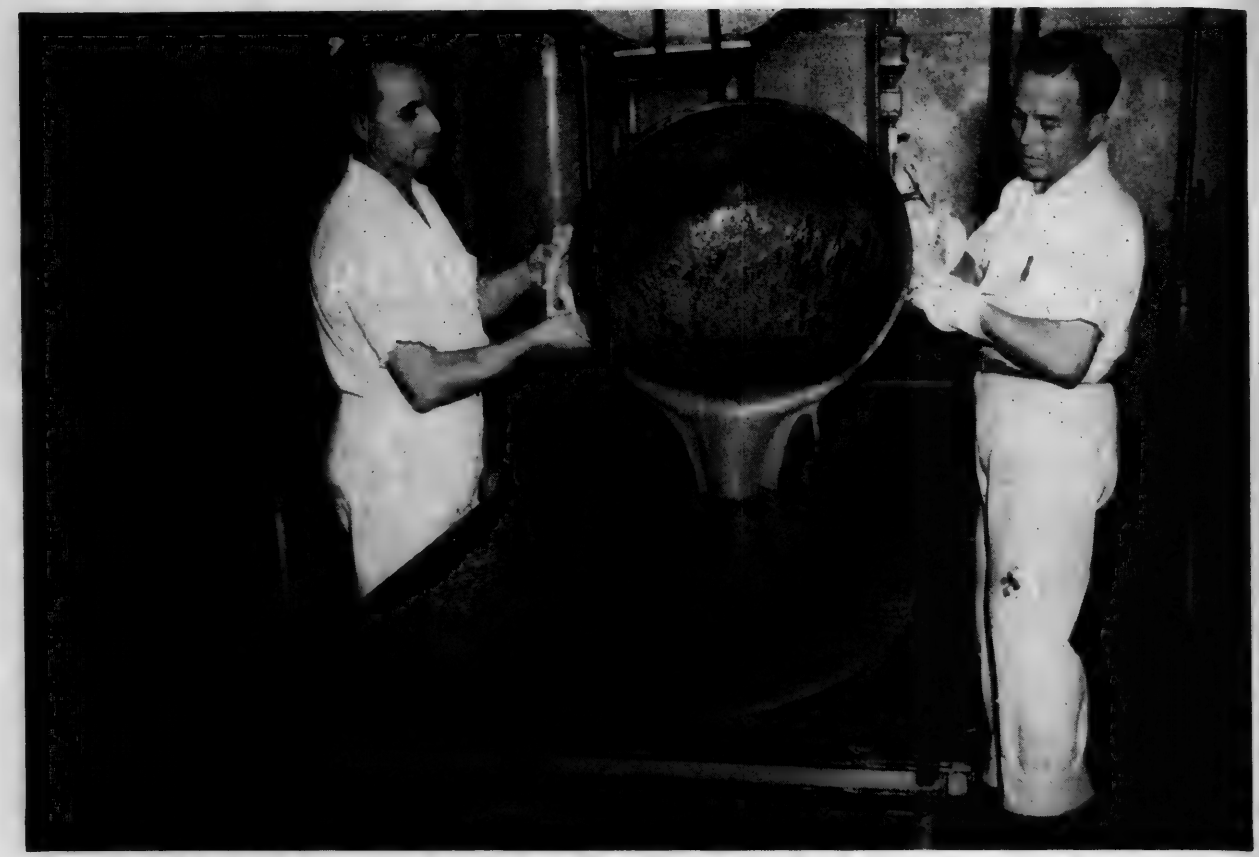
Chilled and Hot Water System: According to Mr. Nicholson, it costs about $1,500 a room to install in existing hotels, and will operate with the same efficiency as a system including packaged units. This type of air conditioning costs much less and can perform an excellent job when it is designed to new hotel construction specifications.

High-Pressure Duct System: This will cost about $700 per room, Mr. Nicholson said. And cool or warm air is delivered to each room as the room atmosphere demands.

In his remarks, Mr. Nicholson advised the hotel men to consider air conditioning as a revenue producer, not an expense. "Also, be cautious about saving money on something that will be in your building as long as it stands," he concluded.

Air Conditioning and Refrigeration for Candy Manufacturing

J. E. SALMON
Engineer, Carrier Corp., Chicago, Ill.



Pouring a hot batch on a water-cooled stainless steel cooling table, a basic step in the manufacture of hard candy. This photograph and the one on the previous page, courtesy, W. F. Schrafft & Sons Corp., Boston, Mass.

Air Conditioning and Refrigeration for Candy Manufacturing

J. E. SALMON

Sales Engineer, Carrier Corp., Chicago, Ill.

The various processes for manufacturing candy are so closely related to proper air and storage conditions, that air conditioning and refrigeration are essential for good production and quality control. This article covers enough of the key stages in the making of candy to understand the need for air conditioning and refrigeration, and the air conditions found most suitable.

THE candy industry in the United States is one of the major fields of industrial production. In 1953 this industry manufactured and shipped nearly three billion pounds of candy, equivalent to approximately 17 pounds of candy for every man, woman and child in this country.

This industry has enjoyed a steady growth from the combination factory, bakery and candy store of many years ago to the modern, high speed, mechanized production plants in the confectionary industry. While this growth is the combined result of many factors, one of the principal causes, however, has been the application of refrigeration and air conditioning in the many intricate processes involved in the production of a finished piece of candy. Some idea of the size of this industry can be gained when one realizes that in the production of the total weight of candy produced in 1953, there was in use approximately 30,000 tons of refrigeration and air conditioning equipment.

There is a great need for air conditioning and refrigeration in this industry as all of the materials used are sensitive to temperature or relative humidity, or a combination of both. This sensitivity directly affects the keeping quality, appearance, workability, reaction, crystallization, and physical properties of the ingredients, as well as of the finished product itself. Air conditioning and refrigeration directly affects the handling and processing of many of the processes, and indeed in many cases these operations are only possible through the use of proper air conditioning. Furthermore, the maintenance of constant temperatures and humidity within the factory spaces

eliminates the variation in production and processes which would otherwise occur through the vagaries of normal weather cycles. Hence, air conditioning becomes an important tool for the candy manufacturer and is directly related to production costs and profit.

No hard and fast rules can be laid down for the design and application of air conditioning to cover all the needs and product formulas for all of the manufacturers engaged in this industry. There are literally thousands of different types of candy produced and even such a standard variety as caramels is subject to wide variation, due to formulas used by a specific manufacturer, and his method of preparation and handling. These variations in formulas and operations will make the particular caramel of one manufacturer react differently to that of some other manufacturer under the same air conditions.

The formulas used in making candy, as well as the cooking processes and temperatures are numerous. However, two of the basic ingredients are sucrose and corn syrup or glucose, and either could be used with a suitable formula and cooking process to produce a finished piece which would be very similar in appearance and taste. However, both of these products are somewhat unstable in that they may easily change from a crystallized form to a fluid or liquid, depending on temperature or moisture content, or combinations of the two. The surrounding temperature and humidity therefore must be controlled to establish the regain or equilibrium moisture and thereby regulate this crystallization and grain structure. However, if the candy in question had cream centers, those made with a high percentage of sucrose could best be processed and held at 85F maximum with 50 per cent humidity. With a similar cream center made from a formula containing a high percentage of corn syrup, the maximum temperature should not exceed about 75F. This is because corn syrup is more susceptible to high temperature and has a higher regain than cane sugar or sucrose.

TABLE 1—USUAL DESIGN CONDITIONS FOR CANDY MANUFACTURING*

Department or Process	Design Conditions	
	DB, F	RH., %
Hot (dry) rooms		
(a) Gums	140-160	....
(b) Jellies	120-140	....
(c) Marshmallows	70- 80	45-55
Dipping rooms	65	50-55
Coating kettles (supply air)	95	15
Cream department	75	40
Caramel department	75	40
Enrober room	80	40-50
Cooling tunnels (supply air temperatures)		
(a) Centers for enrobing	50	....
(b) Enrober	40	....
(c) Hard candy	55	....
(d) Cast chocolate	45	....
Packing Rooms		
(a) Hard candy	70-80	30-40
(b) Chocolate goods	65	55
Storage		
(a) Nuts	30-35	75
(b) Chocolate	50-60	55-60
(c) Finished goods (general)	65-70	40-50
(d) Hard candy (bulk)	75	45

*NOTE: Conditions given in this table are intended as a guide and represent average values which have been found to be satisfactory for many installations. However, specific cases may vary widely from these values due to such factors as type of product, formulas, cooking process, method of handling and time.

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Mr. Salmon is a member of Tau Beta Pi and the American Society of Refrigerating Engineers, and is chairman of the Chicago section of that society. He is a professional engineer registered in the state of Illinois.

Because of these wide variations in products, which to all appearances may be similar or may be similarly classified, no specific requirements of temperatures and humidities can be given which will be ideal under all conditions or for all products. Table No. 1 does give typical ranges of temperature and humidity for various types of candy and candy processes. This, however, is based on average experience and is intended as a guide only. For any specific application there must be a very careful engineering analysis made which may require investigative work with regard to physical properties, moisture regain, specific heat and latent heat of freezing of the actual product under consideration. Basically, it must be borne in mind that the primary consideration in all air conditioning for candy manufacturing is the product and the conditions that are best suited for it and its processing. However, the design engineer must not lose sight of the fact that the comfort of the worker is important and must be considered in the final design of the system.

In general there are several more or less standardized departments or operations, one or more of which will be encountered in any candy manufacturing plant. Fundamentally these consist of the following:

(1) Chocolate
(2) Chocolate coating, dipping and enrober rooms
(3) Bar candy
(4) Hard candy
(5) Starch department
(6) Hot rooms
(7) Cold rooms
(8) Cooling tunnels
(9) Coating kettles or pans
(10) Packing rooms
(11) Storage

There are various general principals of design, ranges of conditions, and peculiarities that apply to each of these processes or departments. These will be discussed in more detail. Fundamentally, however, sensible heat must be absorbed by the air conditioning apparatus employing chilled air in a well designed air distribution system for most of these processes. In calculating the loads in order to determine the air quantities and refrigeration capacities, the typical load calculations for any air conditioning system are employed. It is beyond the scope of this article to go into this portion of the work in complete detail.

The usual sensible heat sources must be considered, such as people, power, lights, sun effect, transmission losses, infiltration, steam heating apparatus, and heat derived from the product itself. Together with this the usual latent heat sources such as those occurring from

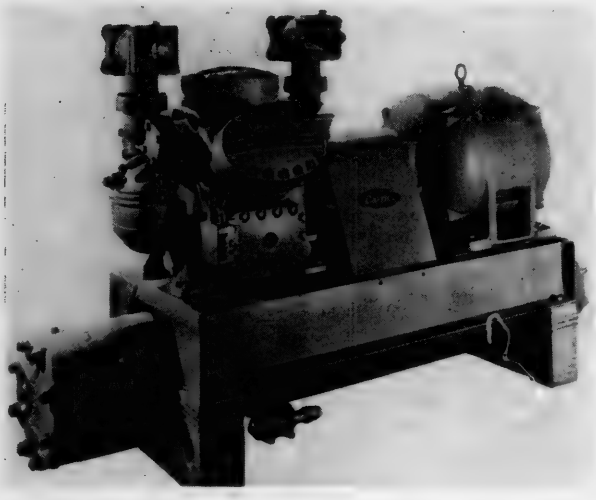


Fig. 1. Type condensing unit used in candy plants.

people, infiltration, outside air requirements, and moisture given off or absorbed by the product, must also be considered. Once the loads are determined, the air conditioning system is designed essentially in accord with conventional practice. Ordinarily for most applications the choice falls to extended surface cooling coils which are served either by a direct expansion refrigerant or a chilled brine. Fans, filters, heating coils, conventional ductwork, air distribution outlets and automatic temperature and humidity controls complete the systems.

Since all of the departments, operations, and processing in candy manufacturing plants, with the single exception of hot rooms, require air conditions having dew-points in the vicinity of 40F, it follows that a refrigeration plant becomes an essential part of the air conditioning system.

Refrigerating Plant

In the past, many candy manufacturers employed a central refrigeration plant using ammonia as the refrigerant. Ammonia is satisfactory from an operating standpoint; however, it is classed as being hazardous and toxic and must be handled with care. For such uses as packing rooms and dipping rooms where a large number of persons are employed, it is important that ammonia should not be directly expanded in a coil in the conditioned air path. A leak at this point would rapidly flush ammonia throughout the entire packing room with disastrous consequences. For this reason if ammonia is to be used, it is recommended that the ammonia be confined to the machine room and that a brine or water cooler be used. Chilled brine or water can then be safely circulated throughout the plant for the various requirements.

In some of the smaller modern plants Freon 12, Freon 22 or Carrene 7 refrigerating equipment (Fig. 1) has been utilized with excellent results. Since these are classed as safe refrigerants, the restriction of direct expansion is not necessary. Often small units are used for each requirement or each group of requirements. Thus one compressor may be installed on a cooling tunnel while separate compressors are used in each of the departments such as packing and storing. This arrangement permits a planned program of expansion or rehabilitation of a portion of the plant at a time, and thus over a period of years, complete modernization of any plant can be accomplished. If the plant is rather large this, however, results in a multiplicity of small units and adds considerably to the work of the operation and maintenance crew. Therefore, serious consideration must be given to the central system although the capital outlay may be large. The central system economics should be examined.

The difficulty of multiple units is eliminated through the use of a centrifugal machine as shown in Fig. 2. This equipment is applied satisfactorily providing there is sufficient load to make its first cost feasible or if management is far-sighted enough to plan for future expansion. If the load is in excess of 50 or 60 tons, the centrifugal fits the picture.

A centrifugal machine consists of a complete assembly of cooler, condenser, compressor and drive, and can be located remotely in the engine room under direct supervision of the operating engineer. Brine piping can be extended throughout the building and great flexibility can thus be achieved. In addition, the centrifugal machine can be driven by either motor or turbine. In many instances the turbine drive proves very satisfactory if it can be fitted into the heat balance of the plant. Most candy plants generate steam at high pressure for use in various cooking operations. Turbines can be obtained either to utilize this high pressure steam, exhausting at a back pressure for lower temperature cooking operations, or they can take exhaust steam to condensing, and thus can be an integral part of the heat balance of the entire plant. The centrifugal has the advantage of extreme reliability, low operating cost, ease of maintenance, and long life.

It has been the practice in the past to refrigerate brine to a temperature of 20 to 25F for all services in the plant, and although this temperature is lower that that necessary for many of the operations, the advantages gained by load factor, balance and central plant operation have warranted this installation. In the past this temperature was necessary because of the design of the evaporators, which in many cases were prime surface coils. Use of modern air conditioning units with fin type evaporators has eliminated the need for low temperature brine. However, experience has indicated that high temperature brine of 28 to 32F is very desirable for central station installations. This brine temperature is sufficiently low to obtain the necessary low dew point temperatures for many of the processes, yet is high enough to prevent frosting on the fin evaporators.

The choice of the brine used is somewhat flexible. Many of the older plants still use successfully calcium chloride or sodium chloride brines. Either is relatively cheap and is completely satisfactory from a refrigerating standpoint. Their use, however, stems from old packing house and brewery practice in the days when these were the only two suitable brines generally known and used. Either may be rather corrosive, and at least in the case of the calcium chloride, a leak which might find its way into the product, is highly undesirable. For this reason, in designing a modern plant or making major extensions and improvements to an existing plant, consideration of more modern and useful brine is indicated.

Various alcohols also have been successfully used for brines and again from the refrigerating standpoint, are completely satisfactory. The principal objections to the alcohols are that they present somewhat of a fire hazard in the event of leaks, and they have very strong odors

Fig. 2. Centrifugal refrigeration units installed at the plant of Mars Candy Company, Chicago, Ill.

which conceivably could be carried over and result in off-tastes in the candy. Another objection to alcohol brines is that in the event of any major repair or remodeling work involving welding on the piping, there is a definite explosion hazard. In doing any work on piping that has carried alcohol brine, it is necessary to open the piping at two ends and to apply a welding torch carefully to the interior of the pipe in order to burn out any accumulated alcohol vapor.

In recent years, two other brines have been used successfully and give every promise of being the most desirable for candy manufacturing plants. These are brines composed of either propylene glycol or ethylene glycol. Both are non-toxic, non-inflammable and they have no appreciable odor. Propylene glycol is actually used in certain food products and hence will not harm any product with which, through inadvertence, it might come in contact.

The only objection to these two brines is that they are somewhat more expensive than other available materials. However, since the average brine temperature in a candy plant will only be in the neighborhood of 28F, the concentration does not have to be very great. Since the brine systems are closed, once the system is filled, the only additional brine needed would be to make up for losses through leaks, and at pump glands. Therefore, the first cost of these brines is of relatively minor importance.

Chocolate

Chocolate is one of the main ingredients used by the candy industry. It is produced separately in either bar or commercial block form and is used as one of the ingrediants in various types of center materials, as well as a coating for candy bars, creams, nuts, fruit and jellies. Chocolate is an amorphous material having no definite and sharply defined freezing point. It solidifies gradually as the temperature is decreased due to the freezing-out properties of the several fats of which it is composed.

For practical applications, the freezing point of high quality sweet milk chocolate is taken at approximately 86F. At the other end of the scale, the lower quality dark chocolate will freeze from 90 to 92F. Actually these freezing points are about the lowest temperature at which the particular grade and type of chocolate is sufficiently fluid to permit easy handling.

It has been found by experiment that considerable latent heat of freezing will be removed as the chocolate is cooled down to temperatures as low as approximately 70F. For average purposes, the latent heat of freezing of the usual grades of chocolate encountered in candy manufacturing will vary from approximately 36 to 40 Btu per lb. An average value for its specific heat may be taken at 0.56 Btu per lb before freezing and 0.30 after freezing. In any sizable application, however, it is always best to run calorimeter tests on the exact grade and type of chocolate used in the actual process under consideration before arriving at the final load determinations.

Chocolate bars or commercial blocks are cast in metal molds after the tempering process. In this process, it is desirable to cool the chocolate in the molds as quickly as possible to obtain the maximum amount of luster or high gloss finish on the finished product. However, too rapid cooling, particularly in the larger size of commercial blocks which is a standard 10 lb cake, may cause checking or cracking. While this is not serious from the standpoint of quality, it adversely affects its appearance. Normal practice calls for chilling the metal molds before the warm liquid chocolate is deposited in them. These molds should be cooled to approximately 60F which is low enough to permit quick setting at the mold surface and yet is high enough so that atmospheric condensation on the molds does not become serious. Even then, the room containing the depositor should be sufficiently cooled to a dew point below the surface temperature of the mold so that there will be no possibility of condensation on the mold.

After the chocolate is left in the mold, the mold can be moved either into a cooling tunnel for a continuous cooling process or the molds can be stacked up and placed in a cooling room provided with forced air circulation. In either case, temperatures of 40 to 50F are satisfactory. It is important that either the discharge room from the cooling tunnel, or the room to which the molds are transferred for packing, be maintained at a low enough dew point so that again no condensation is possible on the cooled chocolate goods. Such condensation will tend to dissolve some of the sugar content which eventually results in a blooming or graying of the surface. In figuring

the loads for the cooling tunnel or cold room, it is necessary to account for the transmission and infiltration losses plus any load derived from further cooling of the molds and the sensible and latent heat cooling loads on the chocolate itself.

Chocolate Coating, Dipping and Enrober Rooms

In the modern candy plant chocolate coatings are applied to the center material in one of two ways. In the coating process, the center material is either formed by hand or cast in starch or rubber molds and is then dipped by hand or mechanically coated. The supply of chocolate for hand dipping is kept in a pan that is normally maintained at the lowest possible temperature to secure sufficient fluidity for the process. This temperature is higher than the dipping room temperature and it is, therefore, a heating process. The most modern plants now have electrically heated dipping pans which are thermostatically controlled.

The dipped candy to which the chocolate coating has now been added, is then either set on trays or on belts while the setting of the chocolate coating takes place. This setting is controlled by air conditioning the dipping room itself. Ideally, as far as the setting of the chocloate is concerned, conditions of 35 to 40F dry bulb would be best since these would promote rapid setting and result in a high gloss to the finished goods.

However, most dipping is done by women and there will be large numbers of these workers in the dipping room. Because of their personal comfort requirements, the temperature is raised so that they can work efficiently. This results in recommended temperature conditions for hand dipping rooms of 65F dry bulb and a relative humidity not exceeding 50 to 55 per cent. The principal problem in an application of this type is to secure even air distribution without objectionable drafts which would have an adverse effect on the workers.

Calculating loads for this type of installation requires, in addition to the normal loads such as transmission, lights and people, the heat load from the chocolate itself, all of which must be summarized with the heat utilized in the warming of the dipping pots.

For high speed production typical of bar work, the chocolate coating is applied in a machine known as an enrober. This machine consists essentially of a reservoir for the fluid chocolate which through thermostatic control, is maintained at the proper temperature for the chocolate. This chocolate is then pumped to an upper flow pan which allows it to flow in a curtain down to the main reservoir. An open chain type belt carries the centers through the flowing curtain of chocolate where the covering is applied.

Some types of enrobers are provided with grooved rolls which pick up some of the chocolate and apply it to the bottom of the center. In other instances, this bottoming operation is handled on a separate piece of equipment which applies the bottom to the center prior to its entry into the enrober proper. The bottoming operation is followed by passing the centers over a bottomer slab to set this bottom coating as rapidly as possible in order to maintain the coating and form a firm base for the piece. This bottomer slab often takes the form of a simple plate type evaporator which may be fed either with chilled water or brine, or may be operated by directly expanded refrigerant. The belt carrying the candy passes over the bottomer slab and the heat from the chocolate is conducted through the belt to the slab.

In this type of work, the centers should be cooled in the range of 80 to 85F to assist in freezing out and retaining the proper amount of chocolate coating. Since chocolate is one of the most expensive ingredients used in candy manufacturing, the enrober is often provided with an air jet arranged to blow directly onto the candy after it passes through the curtain of chocolate. By the proper cooling of centers, plus the regulation of air flowing through this jet, the amount of chocolate remaining in the coating can be accurately controlled.

The belt carrying the now-coated centers, after passing through the enrober and over the bottomer slab, then usually enters the enrober cooling tunnel. This tunnel serves to set the balance of the chocolate coating as rapidly as possible, consistent with high quality and good appearance of the finished goods. The discharge end of the enrober tunnel is normally in the packing room where the finished candy is then packed or wrapped.

While not an absolute necessity, air conditioning of the enrober room is highly desirable. The principal reason for this is the fact that the chocolate used in the coating process is exposed to the room atmosphere. Therefore, it is desirable that the atmosphere in the room be as clean as possible and since filtration is a part of any air conditioning system, this in turn prevents the contamination of the chocolate with foreign material. When conditioned, it is advisable to maintain conditions of 80F and 40 to 50 per cent relative humidity. These conditions will be low enough to prevent the centers from materially warming up during the time they are exposed in the enrober room. The conditions will also assist in the setting of the chocolate coating after it is applied to the centers as it passes over the bottomer slab which is also often located within the enrober room.

Bar Candy

Present day operations for the production of bar candy call for high speed semi-automatic production in order to keep production costs to a minimum to meet the highly competitive market found in the bar candy field. In the production of bar candy, the center material is delivered from the kitchen to spreaders which form layers on slabs, or the material may be cast into starch molds. Depending on the composition of the center, the hot material may be delivered at as high a temperature as 160 to 180F. Successive layers of different color or flavor may be placed one on top of the other to build up the entire center material. This may normally consist of nougat, caramel, marshmallow and whip, to which may or may not be added peanuts, almonds, pecans or other nuts.

Since each of the ingredients require different cooking processes, each separate ingredient such as caramel and nougat, is normally deposited in a separate operation. Thus for example, a ⅛ inch layer of caramel may be first deposited on which is then spread a layer of peanuts, followed by a ¾ inch layer of nougat, each of these layers being applied in a separate and distinct operation to build up the completed center.

After the center material is deposited, it becomes necessary to allow time for the setting of the various ingredients and the cooling to the best temperature for enrobing. In older operations, this is accomplished by depositing the center material on large tables which may be as large as

approximately four feet by ten feet in size. These tables are then pushed into a cooling room which should be maintained at about 80F and 50 per cent relative humidity, where they are allowed to remain for periods up to 24 hours. Following this cooling, the center material is then cut into pieces the size of the finished center and these are then placed on the belt to carry them through the enrober for their chocolate coating.

Modern high-speed operations call for more rapid handling and more continuous processing than is possible with the older slab method. The more modern, high speed production plants are therefore depositing the various center materials onto a moving belt which may either be canvas or steel. This belt is provided with edge belts to keep the semi-liquid candy from flowing over the edges. After each successive depositing of the ingredients, the belt passes through a cooling tunnel where the cooling and setting up of these ingredients are accomplished. This same belt then delivers the finally finished and cooled center material to rotary cutting knives which slice it to the finished width and then through transverse cutters which cut the separate pieces to length. This is all done in a continuous operation and the finished dimensionally sized pieces are then passed directly to the enrober belt for the chocolate coating.

Hard Candy

Hard candy is normally produced in a batch type of operation. The basic ingredients are cooked in the kitchen and the liquid mass is then delivered to the table of a kneading machine. This machine then physically works the candy to accomplish the proper crystallization and grain structure. The tables of the kneading machine may be steam heated to properly regulate the temperature of the semi-molten mass.

This plastic mass is then formed into a billet and is delivered to the batch rolls where through a combination rolling and drawing process it is strung out to the proper size and is then either cut off to form sticks, or may be impressed into molds to form balls, fruit drops, and the like. This latter machine may also be steam jacketed since the mass of candy must be kept in a sufficiently plastic state to handle properly through the forming operations. This part of the operation is normally not air conditioned but the delivery of the finished piece usually is into a conditioned space. In this space, the candy must be cooled as quickly as possible so that it will preserve the finished shape and sticking will be prevented.

Hard candy is especially susceptible to both temperature and relative humidity, since if either are too high the candy will stick together and difficulty will be encountered in handling and the various operations involved. Conditions to be maintained in the hard candy room normally are in the range of 65 to 75F with relative humidities ranging from 30 to 40 per cent. This results in rather low dew point conditions for the conditioned air supply system and in view of this, it may become desirable to consider the use of standard dehydrating systems employing chemicals such as lithium chloride or silica gel. If a dew point of 40F or less is needed, a combination installation of these absorption systems with refrigeration becomes an excellent choice.

The quantity of air required is a direct function of the sensible heat of the room, including the heat derived from the product, and must be calculated with care. Distribution of this air is also of great importance and air distribution outlets should be spaced evenly throughout the area to insure uniform conditions and eliminate the possibility of drafts on the workers. Where the finished product is stored in containers or tubs, special consideration must be given to the increased air quantity required in these areas to prevent sticking of the finished product.

Starch Department

A large portion of the candy manufactured in modern candy factories is produced by use of the starch molding process. This process is carried on fundamentally by a machine known as a mogul. This is a piece of equipment normally about five feet wide and approximately 20 feet long. It consists of two endless chains which carry starchboards through the unit. The starchboard is constructed of wood and is a tray having approximate dimensions of 35 by 15 by 1½ inches in size. These trays are provided with an extra ½ to ¾ inch blocking at the bottom in the four corners, so that they can be stacked satisfactorily and still provide space for air circulation between boards.

The starchboards containing starch and finished candy are delivered to the mogul where they are inverted and the starch and candy is separated by means of a screen and brushes. The candy is then conveyed to the packing room or to other operations.

The tray is turned upright and is filled level full with fresh starch. It then passes through the imprinter which is a die the shape of the finished piece of candy. This die is forced down into the starch and creates an impression in the starch which is similar to a sand mold in a foundry operation. The board with the impressed mold now passes through the depositing section of the mogul where liquid candy in exactly the correct amount is pumped into each impression. The board with the deposited candy still in liquid form then emerges from the mogul and is either automatically or manually stacked on special dollies and is conveyed to a conditioning or dry room for cure or crystallization, as the case may be.

The function of this process is two-fold. The starch becomes the mold for sizing and controlling the correct shape to the finished piece. By proper regulation of the moisture content of the starch, it also serves to help regulate, in conjunction with proper air conditioning, the final moisture content, texture, crystallization, and appearance of the finished piece. The starch itself is continuously taken off of the mogul and passed through standardized starch drying equipment where the moisture content of the starch can be closely regulated before it is returned to the mogul and reused in the process.

While air conditioning of the starch room in a candy plant might be desirable, it is not critical and is seldom done. Part of the reason for this is the tremendous difficulty encountered with starch dust in the atmosphere as this dust would tend to rapidly clog filters, cooling coils and the like. For this reason, a high degree of ventilation, using all outside air with proper filtration on this air, is all that is normally recommended.

One caution must be observed and that has to do with the rather serious explosion hazard created by the starch dust that almost inevitably fills the starch department. Good housekeeping practices are mandatory on the part of the manufacturer in order to prevent an accumulation of this dust and furthermore, added precaution dictates the use of explosion proof and static-free equipment.

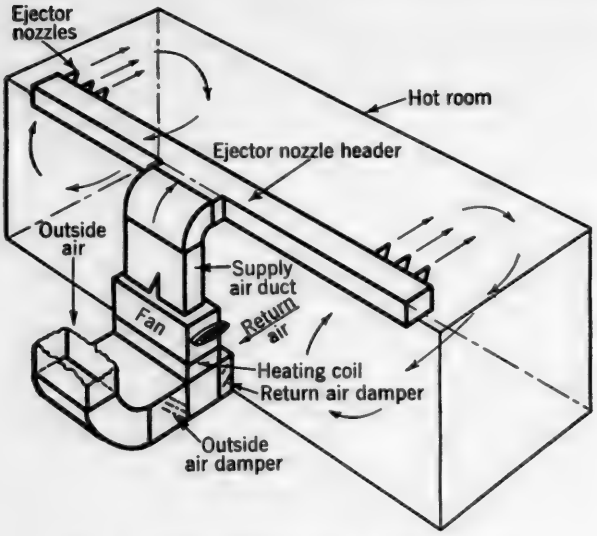


Fig. 3. Typical arrangement of hot room system.

Hot Rooms

The drying and finishing of such products as jellies and gums can best be accomplished in air conditioned hot rooms. These products are delivered from the starch department in stacks 30 to 60 boards high, mounted on special dollies. These stacks are loaded in the hot room which is usually sized to take about one day's production from the mogul.

The normal drying temperatures for this type of product will average between 120 and 150F dry bulb, and while the humidity is of importance, close control of this humidity is not necessarily needed since a check of the psychrometric chart will indicate that even with the maximum normal outside temperature conditions normally encountered, when this air is heated to 120 to 150F, the relative humidity will be low—only from 19 to 13 per cent. Most operators prefer to leave the humidity control under manual operation since in their regular inspection of the product during the drying process they can, from experience, determine whether the product is drying too fast or too slow and can then increase or lower the relative humidity by varying the quantity of outside air.

The important problem in the hot room is one of air distribution and it is necessary to so arrange the product and the air flow so that the maximum amount of air will be in contact with the product. The first step is to provide space between trays as previously mentioned. The second consideration is the location of trucks within the hot room. These must be so placed that a continuous flow of air from truck to truck can be assured with the shortest possible path for the air flow. In addition, adequate space must be maintained at the entering and leaving-air sides in order to assure adequate flow from the top to the bottom tray for each stack. A large air quantity is required in order to secure uniformity over the entire product zone.

One method of securing this, which has proven very satisfactory, is the ejector nozzle system, shown diagramatically in Fig. 3. Basically this system consists of a supply header fitted with conical ejector nozzles. These nozzles are so designed to have a tip velocity of 2,000 to 5,000 fpm with a static pressure behind the nozzle ranging as high as 1½-inch water gauge. Nozzles so set up will induce a flow of air about three times that actually supplied by the nozzles. This 3 to 1 ratio gives about the best economical balance between air quantity supplied and fan horsepower.

In an ejector system it will be noted that the primary and induced air streams mix over the product and sufficient space between the top tray and the ceiling must be allowed to permit this mixing. In effect, this mixing rapidly decreases the necessary differential between the air supply temperature and the actual room temperature. The high air flow thus created tends to decrease the temperature drop across the product, it being obvious that since the temperature drop is proportional to the heat pick-up, a greater air flow will therefore have a lower temperature drop. The result of this is that the spread between the air temperature entering and leaving the product zone is reduced. This in turn promotes uniformity of drying.

Equipment that is recommended for this type of operation consists of a fan and heating coil unit which may be suspended from the ceiling inside the hot room proper or directly adjacent to it. This unit is provided with outside air intakes and ejector headers as indicated. Return air dampers are provided, as well as dampers for the outside air intake. Most operators prefer to use recording controllers in order to maintain an accurate record of each batch. This contoller simply regulates the flow of steam to the heating coil in such a manner as to maintain the desired room temperature. It is usually advisable to provide gradual switches to control the position of the outside and return air dampers since on a rise in humidity, more outside air should be taken, and conversely with a drop in humidity, more return air should be taken. This function can be provided automatically by a humidity control, but this is seldom used. An end position can be included on the gradual switch for the cooling down period so that under this circumstance the outside air damper is opened wide and the exhaust fan is started.

Cold Rooms

Many products in the confectionery industry require chilling and drying but cannot withstand high temperatures as indicated under the subject of hot rooms. Typical products in this category are marshmallows, certain types of bar centers and cast cream centers.

In this type of work it is usually found necessary to maintain drying conditions of about 75F and 45 per cent relative humidity. The drying period of this type of product will vary from 24 to 48 hours. Basically, the system recommended is the ejector type outlined for the hot rooms, the difference being that cooling coils are provided in the air conditioning unit. The load must be carefully calculated to arrive at the sensible and latent heat quantities from which the actual air quantity can be determined, together with air supply temperature and refrigerant temperature.

When properly balanced, the control of relative humidity becomes an inherent part of the design of the system. The control system recommended is basically the same as for the hot room except that the recording regulator in this system must control the admission of steam to the heating coil in the wintertime or regulate the flow of refrigerant to the cooling coil in the summertime.

There is one precaution which must be observed in the equipment for the cold room and this is in connection with the starch or sugar dust that is normally picked up

in the return air stream. Under the cooling cycle, the cooling coil is normally condensing moisture and the accumulation of starch or sugar dust will rapidly form a paste on the cooling coil. This will seriously reduce coil capacity and cause considerabe nuisance in the maintenance and cleaning of the equipment. For this reason it is recommended that filters always be used to filter both the outside and return air entering the cooling coil.

Cooling Tunnels

There are various cooling requirements in the usual candy plant which can best be handled in a cooling tunnel. Typical of this work is the process of cooling coated centers after leaving the enrober, cooling of cast chocolate bars, and the cooling of hard candy. These operations are usually set up for a high rate of production and a continuous flow of product. Hence the product is normally conveyed on belts either through the enrober or the casting machine, as the case may be, and is then carried through a cooling chamber.

Basically, a cooling tunnel consists essentially of an insulated box placed around the conveyor in such a manner that the product travels through this housing in a continuous manner. Cold air is supplied to this enclosure to cool the product. To secure maximum heat transfer between the air and product, it is desirable to employ the counter-flow principle whereby the air is introduced at the product leaving end of the tunnel and is withdrawn at the product entering end of the tunnel in such a manner that the direction of the air flow is opposite to the direction of the material flow. Figure 4 is an illustration of a typical cooling tunnel application employing the principles mentioned.

In general, air supply temperatures of 35 to 45F have been found satisfactory for most of this type of work and air velocities up to 1,500 fpm are normally employed. This high velocity improves the heat transfer and creates a turbulent condition in the air flow which gives further improvement in the heat transfer efficiency.

The actual size of the tunnel is determined from the size of the conveyor belt and the air quantity set up to give velocities in the order of that mentioned. The air quantity is dependent on the heat load and the rate of cooling desired; however, in general, it is wise to limit the rise in air temperature through the tunnel to 15 to 20F maximum and it is good design to use one air conditioning unit for each tunnel.

This unit normally consists of a fan and coil together with the necessary duct connections to and from the unit. Good practice requires an outside air intake since there are many times when the cooling can be accomplished with outside air at a saving in cost in operating the refrigeration plant. The tunnel should be made as tight as possible and the entrances and exits for the candy should be reduced to the minimum to limit either the loss of conditioned air from the tunnel, or air infiltration to the tunnel which would tend to upset the conditions. In some cases it has been found advisable to use flexible canvas curtains to accomplish this purpose. Some loss is unavoidable and it is the general practice to take a small amount of outside air, or air from the adjoining spaces, in order to provide a slight excess of pressure in the tunnel.

For chocolate enrobing tunnels, the condition of the air is the paramount factor in securing the best possible luster on the chocolate together with an even coating.

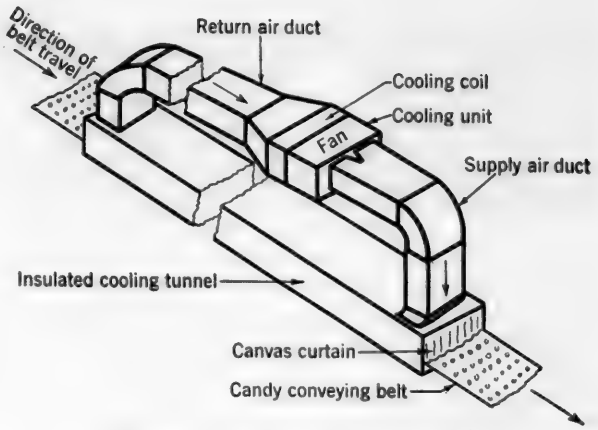


Fig. 4. Typical candy cooling tunnel.

Best results are normally obtained with rather slow cooling but this in turn means either a low production rate or excessively long tunnels. As a result, the final design is normally a compromise.

It is also essential that the chocolate be at the proper condition at the time it is poured over the centers since a temperature that is too high or too low at this point will result in blushing or loss of luster in the tunnel. This, however, is a function of the enrober machine and its operation. A similar phenomena is experienced if the centers are too cold or too hot, both conditions resulting in poor appearance of the finished goods, which no amount of correction in the tunnel will compensate.

Coating Kettles or Pans

Many candy plants employ coating kettles or pans to provide a sugar coating to small pieces, such as chewing gum, and to provide for a polish and high luster on these pieces. The coating pans are normally about two feet in diameter and three feet long. They are mounted in gangs of approximately eight each at about a 45° angle, with a belt or gear drive arrangement so that the pans will revolve. The center material is introduced to the pan, the pan put in motion, and a tumbling action obtained. The coating material is then ladled into the pan in a liquid form and through the tumbling action, becomes evenly distributed on all of the product within the pan. It is necessary to build up the coating by many applications to arrive at the final thickness and weight of the coating. Where a high polish is desired, it is often necessary to add wax.

The application of air conditioning to revolving coating kettles or pans has proven very satisfactory. Originally these pans were merely provided with a supply of rather warm air, usually ranging from 80 to 125F. This air was then exhausted from the kettle directly to the room and it created a severe nuisance from the standpoint of sugar dust being blown out of the kettle. In addition, a portion of the energy required to produce rotation of the kettle degenerates to heat in the centers being coated with the result that expansion may tend to produce cracking or checking. For this reason it is general practice to apply a portion of the coating, withdraw the product for a seasoning period ranging up to 24 hours, and then return the material to the kettles for additional coating.

Installations have been made using a conditioned sup-

ply of air to the kettles and they provide a positive exhaust system from the kettles. Thus, a large portion of the sugar fly problem is overcome. In addition, the wet and dry bulb temperature of the air supplied to the kettles is closely controlled with the result that the rate of evaporation and hence the drying of the coating can be controlled to give uniformity with a high production rate and a lowered labor cost.

Evaporation of the moisture in the coating material tends to take place at the wet bulb temperature of the air supplied to the kettle. In this manner a large portion of the heat of rotation entering the product is absorbed and overheating of the centers is not experienced. This eliminates the need for a seasoning period and it is possible to make a complete run without stopping, which in some instances may be from six to eight hours, depending on the nature and the amount of the coating applied. With air conditioning applied to coating kettles, a very material reduction in the number of rejects caused by splitting, cracking, uneven coating or doubles can be accomplished. Recovery of sugar fly is accomplished by means of roto-clone or other similar dust extracting device.

For candy-coated chewing gum, normal air supply temperature to the coating pans at 95F has been found to be satisfactory. Coincidental with this, the supply air temperature should be kept to about 15 per cent relative humidity for a dew point below 40F. If this is accomplished by use of refrigeration equipment, then a very considerable amount of reheat becomes necessary. A somewhat better method is to use absorption equipment employing lithium bromide, silica gel or the like. In this case the conversion of latent to sensible heat is actually desirable since the delivered air from such equipment will be at a rather high temperature, but at a very low relative humidity. In view of this, such sensible heat cooling on this air as may be required following the moisture absorption, can often be accomplished with city or cooling tower water without the use of mechanical refrigeration.

Packing Rooms

The packing room, where the finished product is placed in its final container, should always be air conditioned. As long ago as 1925, one authority on candy production stated, "One of the prime requisites of successful packaging is conditioned air." The average manufacturer spends considerable time and effort in the correct design and application of packing and packaging materials for his product. It is recognized that this one item very materially affects the keeping quality of the goods. The end result is to provide more nearly moisture-proof containers for protection against regain of moisture to the product under abnormally high humidity conditions.

Often the manufacturer overlooks the fact that the weather in his packing room is the atmosphere with which he actually surrounds his product when placed in one of these moisture-proof containers. It follows, therefore, that the control of this weather is essential if the whole theory of proper packing is to be made valid. For example, a product packed in a room having conditions of 85F dry bulb and 60 per cent relative humidity, which may easily be encountered in a normal summer, would have air surrounding the product at 69F dew point. If this sealed package were then subjected to temperatures below 69F, the air in the package would tend to become supersaturated and moisture would condense on the surfaces of the container and the product. If this product at a later time were then subjected to a higher temperature, the moisture would re-evaporate. In this process if the product were chocolate it would lose its luster, and if marshmallows, a sticky or grained surface would result, depending on the formula used. Other products will show similar deterioration, either in appearance or quality.

Obviously then the control of the air conditions in the packing room is essential. In actual practice, conditions of 65F dry bulb and 55 per cent relative humidity have been found to be about the maximum practical. An improvement will be obtained if the relative humidity can be dropped several points. In the case of hard candy where this material is intensely hygroscopic, the relative humidity should be reduced to 30 or 40 per cent, but a somewhat higher dry bulb temperature up to a maximum of 80F can be tolerated.

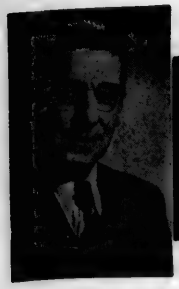
Storage

Every manufacturer is anxious to have his products reach the ultimate consumer in the same fine quality that they leave his plant. If the products could be sold to the ultimate consumer immediately after finishing, there would be no problem in this regard; however, it is usually necessary, particularly with seasonal items, to provide storage facilities to even out the production requirement on the factory.

Therefore, it becomes necessary to air condition the storage spaces to insure the products remaining in prime condition. Generally speaking, it has been found that most types of finished goods will keep for a considerable length of time if stored in room conditions not to exceed 70F dry bulb with 40 to 50 per cent relative humidity. An exception to this is in the case of the storage of nuts where the dry bulb temperature is normally held between 30 to 35F with the relative humidity at 75 per cent. These conditions prevent excessive dehydration of the nuts, and at the same time they retard any mold growth and tend to keep any insect eggs dormant.

The conditioning of the storage room is a relatively easy matter, it being the usual practice to use the unitary type of equipment known as cold diffusers. These are fan and coil units connected to an external source of refrigeration. The number and size used is determined by load requirements and air distribution. Usually these units are fitted with directional flow outlets and no additional ductwork is necessary. The population load in these rooms is very low so drafts ordinarily are not objectionable. It is only necessary to secure air distribution to all parts of the room. In this connection, sufficient space must be allowed between the top of the loaded product and the ceiling to provide a plenum chamber for the distribution of the conditioned air.

If the product is to be withdrawn during hot humid summer conditions, it is generally wise to provide a tempering space directly adjacent to the shipping dock where the goods removed from storage can remain for about 24 hours before shipment. This space should be maintained at about the outside dry bulb temperature and a rather low relative humidity. This permits the product to warm up to the outside temperature without the danger of sweating. It can be done by taking a small outside air quantity on one of the units handling the storage room. This air would then be relieved through the tempering space to maintain the required conditions.



Experience is my Classroom

By T. W. REYNOLDS

• FAIRNESS IN SPECIFICATIONS

I confess that for some time with the passing of each year I was guilty of writing ever longer and more double barreled legal specifications which were read less by those bidders who knew how to perform with no more guidance than a mere declaration of the work to be done. In those earlier years I did not realize the mutual dependency of engineers and contractors. I unintentionally wrote things tending to put those out of business who were necessary to my own business. My specifications were fair to the engineer and that was in the main all that seemed to matter, even if they went so far as to make the contractor responsible for the engineer's design.

The specifications were of course made fair to the owner as well, particularly where bidding was unrestricted. Apparent perfection introduced imperfections and made the contractor sign away his constitutional rights. Somehow, the finished job was never as perfect as the specifications.

Clauses for Protection

Of course, many clauses are written in specifications to offset the possible inclination of some contractor to take advantage of unforseen ambiguity and vague description where verbage is too lengthy and redundancy produces contradictions. An argumentative contractor who looks first for such things, when bidding on understandable specifications, can cause much delay and trouble. However, considering that we are or should be endeavoring to reach a two-sided agreement under which two parties can cooperate, it is worth while to consider what clauses are either unfair, or can be made so by the power of but one party to the contract.

An unfair clause which may or can be used as a club tends to limit competition. In any event, the tendency is to lower the standard of honesty and to use some questionable means to void or offset what is considered unfair. One may argue that no one would dream of attempting to enforce a particular clause and that it is merely there for general effect or contingencies; since it would not be upheld by any court, and is harmless, why worry about it. But like the loaded gun, it is harmful if used.

Every contractor knows that his reasonable profit or unreasonable loss on a job depends in a large measure upon the broadness and fairness in interpretation of the contract by the engineer in direct charge. The owner may even receive higher contract price where the bidders know the engineer to be unfavorable in this respect. Those who interpret specifications are more powerful than the specification writers. Therefore, there is objection to those saving or club clauses, which although intended more for job protection than literal enforcement, are sometimes fully applied by the over-conscientious engineer, just to secure strict compliance regardless of good performance. Specifications should be viewed only as an ideal or standard to be reasonably approximated and, curiously enough, are so viewed by an engineer once he enters the employ of a contractor.

The engineer who insists on hair splitting exactness is apt to be easier to fool than the practical engineer who gages results and sees that the contract is lived up to more by spirit than by precise letter. The careful engineer, however, is so busy inspecting that he may never find time to learn real engineering. Furthermore, when an occasion does arise whereby a contractor may retrieve all or part of a loss by some concession, the engineer may not grant it, or he may demand a deduction from the contract price.

Offsetting a Loss

There are many honest ways that an engineer can allow a contractor to make up a loss without injury to the work, or occasion any real departure from the intent of the specifications. Were this not done, some needless loss to which the contractor through lack of practical interpretation, may be retrieved by some skimping of work not considered too vital by the contractor. He may be as justified in safeguarding his pocketbook as the engineer is for his reputation by the use of formidable clauses.

The bidder is told in the specifications that he must visit the site to determine conditions for himself. Conditions are not always easily discernible by inspection, and since he is as yet just a bidder, he cannot and is not allowed to take time to fully explore. He must be guided by unguaranteed information which the engineers have developed. If such information is misleading or does not cover everything, the contractor takes the loss. Should not the contract provide for such a contingency, especially so since the engineering expert has had more time to investigate existing conditions and is supposed to have superior knowledge?

Possible Delays

It may be written that the owner or others furnishes certain equipment or material. Suppose such things are not there when the contractor is ready for them, must he then delay his work and protect unfinished items until "others" are ready? The same remarks apply to the removal of existing conditions by the owners or others. Often, however, all such things become a part of the contract, in which event many troublesome questions are avoided.

Further delay may be occasioned by the owner when the work is almost finished because he has changed his

mind—wants to add, subtract or alter. The delay may be for, say, four months, so the contractor is allowed as per specifications an equal extension of time to finish his contract. This on the face of it looks fair enough, but the contractor cannot resume his work with the same expedition as when stopped and meanwhile he is on guarantee to make good any defects within, say, two years after receipt of final payment. Interest on any retained percentage of the contract price is also lost for the same period of time.

Here follows a good clause for the engineers' viewpoint:

"The drawings and specifications are intended to be explanatory of each other, but should any discrepancy appear or misunderstanding arise as to the import of anything contained in either, the explanation of the engineer shall be final and binding on the contractor. Any correction of errors or omissions in the drawings and specifications may be made by the engineer when such correction is necessary for the proper fulfillment of their intention as construed by him."

Usually this clause goes farther and holds the contractor responsible for failure to direct attention to any errors he may have discovered. Anyhow, it is a clause that could be rewritten to cover what is undoubtedly in mind, an attempt to forestall extra pay for work obviously intended to be included, but claimed because this particular work was not covered in detail. This usually arises from an over detailed specification for all things but this one, for example say, the failure to enumerate the number of nails per shingle. This could result in the use of only one nail per shingle on the contention that since this item alone was not detailed, the contractor was given freedom of action.

Often the bidder must give unit prices at which either additional or lessened work will be paid for. Since this work may be done piecemeal and the material bought in smaller quantities and at higher prices, he is apt to raise his unit prices. But some other bidder may give low unit prices for more favorable comparison. In my experience, one such contractor was awarded a contract with the engineer's deliberate undisclosed intention of substantially adding to the work and this was later done at his extremely low unit prices. It cured this contractor, but in a way I disliked.

A contract should stipulate a reasonable time after completion when final payment is to be made. But why go on? Enough has been given to convey the general idea, and show how the power given the engineer can do much harm is not wisely used. In some cases, the successful bidder must even sign a contract that the engineer can remove him from the job for cause as the engineer sees fit, and this on short notice without any action at law. This presupposes that the engineer is a better lawyer than the courts. In any event, it makes him paramount.

The contractor is to a certain extent a gambler. He gambles on the existing things below ground or back of the walls, the number of leaks his connections will cause in existing piping and how much he will have to delay to suit owners' operations. He also gambles on the elements, accidents, estimates, and varied other contingencies, and finally in his bid on the hope that the engineer will give him the better side once in a while. He further hopes the final work will be inspected on time, at one time, and by not too many differing departments, and that certain work will be inspected as it progresses before more labor is added to it.

Radiant Heating Installation Cost is Important

Cost is an important factor in determining whether a radiant heating installation is acceptable and is considered economical, according to William P. Chapman, engineer, National Tube Division, U. S. Steel Corp., in a talk before the National District Heating Association, May, 1954.

Radiant heating will be universally accepted only if proper installation is economical. Good engineering and common sense can make a proper installation economically feasible. The panel should be prefabricated, if at all possible. Every extra turn and offset will cost at least 20 cents. Two good rules are: (1) pipe size and pipe space should be kept to a minimum and (2) panel dimensions should be kept down to truck bed dimensions. By following these two rules, the panels can be prefabricated in a shop and hauled to the job site. This will save field work and will reduce costs.

For example, as a rule, maximum panel dimensions are 8 ft by 40 ft. Panels longer than 40 ft cannot be hauled through city streets. Where panel size is held down so that it can be easily handled, then several prefabricated panels can be used and welded together. With two such panels, only one or two field welds are required.

In the accompanying table are given the probable installation costs of radiant heating in six areas of the United States. These costs are competitive with costs for steam or hot water radiator systems. They are somewhat higher than warm air, but within selling range. For this added cost, there is a benefit. Air ducts and pipe shafts take up rentable building volume and therefore this factor must be considered. However, some advantage is lost because air is required for ventilation.

The radiant heating system is a little more efficient in its heat distribution, although in general, warmth will cost about the same, Btu for Btu.

ESTIMATED INSTALLATION COST OF RADIANT HEATING FOR VARIOUS AREAS

(Adjusted to design conditions of 0 F)

Area	Installation Cost in Cents per Sq Ft of Floor Space
New England	83
Central Atlantic	65
North Midwest	70
South Midwest	55
Rocky Mountain	96
Pacific Coast	85

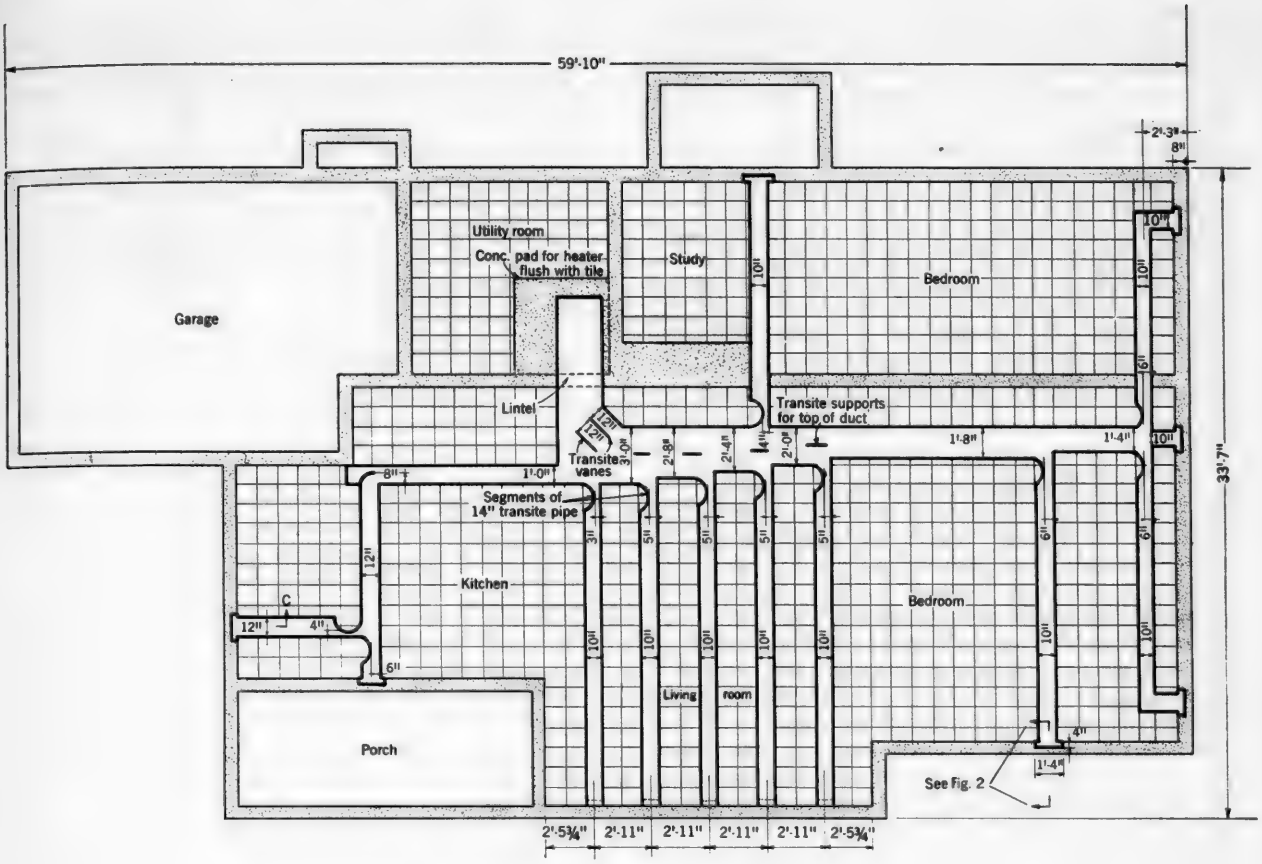


Fig. 1. Layout of duct system under tile floor.

Radiant Heating with Warm Air— A Split-System

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The method of radiant heating with warm air is no longer a novelty; in fact, as investigation of the ancient Roman baths has shown, it is over two thousand years old. However, the description that follows concerns a heating system according to this method, that was something of a novelty in America in 1947, when it was installed.

THE installation to be described here was, in a sense, experimental in that the designer had very few criteria at hand that could be applied directly to his problem of heating an entire house by the method proposed. Two years previously, he had successfully heated the lower floor of a small dwelling by the same method, but the question of distribution had been a relatively minor one. However, this previous installation had given him some techniques and rules of thumb that had proved workable.

The house was built in Mill Neck, Long Island, for Mr. John C. Schulz. Mr. Schulz established certain fundamentals of the design program and the site dictated others. The house was to be of one story, without a cellar, and was to contain a living room, master's room, bedroom and study, as well as a bath room, kitchen, utility room and car shelter. The living room was to enjoy a view over Long Island Sound. The site, on the north shore of Long Island, is a rather steep, wooded bluff overlooking Mill Neck Creek and the Sound. It faces north-north-westerly and receives only high sun from the east and south; during the warmer months it also gets some low sun from the West. Such a location is very nearly ideal for the summer, but its exposure to the coldest winter winds makes it far less than ideal, in the heating sense, for any other season.

The house is of typical woodframe construction, somewhat modified to accommodate the plywood which covers it on both the exterior and the interior. The south wall and a part of the west wall, having been built into the bluff, are of concrete block to windsill level and of woodframe above. The foundation is of poured concrete and the floor is a hollow tile slab. All exterior walls and the

roof are insulated with 2-inch glasswool batts. To take advantage of the view, a rather large proportion of the wall-areas facing north are glass, the exterior wall of the living room being almost nothing but picture-window. By an arrangement of roof levels high clerestorey windows were contrived in the south walls of the living room and bath room; these admit some sun and provide effective ventilation.

Because of both the exposure of the site and the general climatic conditions of the latitude the designer decided, from the outset, that a radiant floor, alone, would not be sufficient to overcome the heat-loss through the exterior walls and their windows—the north walls in particular. However, while it was evident that some more direct means would have to be employed to help overcome this loss, it was also apparent that a heated floor was necessary to avoid the discomfort that would be caused by a slab on the ground, even though this slab were insulated and absorbed some measure of warmth from the air of the house. Since it had proved its worth two years previously, a split-system was decided upon as best providing both a warm floor and a direct curb upon the heat-loss. In such a system, the warm air is blown under the floor to the outside walls and is then introduced to the room through registers beneath the windows. The floor is heated in transit, as it were, and yet the air retains enough warmth to effectively blanket the cold air-drop from the windows. A further virtue of this system, which also influenced its choice, is its adaptability to air-conditioning; the air may be humidified or dehumidified and, in the summer, cooled.

Common, hollow, partition tile, 12 inches square and 4 inches thick, were selected as best fulfilling floor requirements. Laid upon a 4-inch bed of sand, over 6 inches of gravel, and overlaid with a 2-inch slab of concrete, they provide the core of a hollow slab that covers the entire floor area of the house. Since the sub-soil on the site is gravelly, it, plus the sand and gravel bed, supplies good drainage as well as good insulation; the 4-inch thickness of tile, therefore, is adequate as a prime insulator.

As distributors of heat, the hollow-tiles would have been used most ideally as air-ducts in themselves; but the friction-loss through their small cores (about 3 inches square) would have been too great for the furnace-blower to overcome. The airducts, therefore, had to be formed independently, by omitting rows of tiles. As shown in Fig. 1, the floor system, then, is a hollow slab traversed by channels for air distribution, the tiles performing the function of auxiliary heat distributors and insulators.

The tiles bounding the air-channels were laid with their cores parallel to the channels so that there is no air distribution through them, but only a distribution of heat by means of their solids and the dead-air spaces of their cores. Had they been laid with their ends open to the channels, the resulting turbulence in the air-flow would undoubtedly have increased the friction loss, as well as the dynamic loss, beyond the capacity of the blower. And there is reason to suppose that, in addition, there would have been a short-circuiting of the air-flow that would have made any kind of control very difficult.

With their walls of hollow-tile, the air-channels were roofed with sheets of Transite, 1/8 inch thick, over which were laid strips of wire lath, weighing 3.4 pounds per square yard, as reinforcement for the 2-inch slab (the same reinforcement was included in the slab under partitions). Their floors were insulated against heat-loss to the ground with 1-inch thick asbestos millboard; the same millboard was used as insulation for the roof of the main supply channel at the furnace outlet. Fig. 2 illustrates typical channel construction.

As can be seen from the channel layout in Fig. 1, all channels lead to the exterior walls. Here metal ducts in the walls carry the air up to registers under the windows, as is shown in Fig. 2a. In the exterior wall of the living room, which is composed of there picture windows, the wide, wooden window stool was pierced to form a series of grilles for its entire length.

The total air-supply, therefore, ultimately finds its way into the house by means of these registers. It is returned to the furnace through two grilles, placed on either side of the living room, one in the ceiling of the passage connecting the bedrooms and the study and the other in the ceiling of the passage leading to the kitchen and the entry; both ceilings have a height of 7 ft 1 inch.

Once it was determined that the vented warm air alone should be capable of directly overcoming the greater part of the heat loss through the exterior walls, it seemed most reasonable to base the system design primarily upon a duct system that would deliver enough warm air to these vulnerable areas, rather than upon the floor as a radiant panel. Accordingly, the heating load was calculated in the usual manner. Design conditions were selected as follows:

Outside Temperature	0F
Inside Temperature	70F
Inside Temperature, Bath Room only	80F
Temperature Differential between the ground and the upper surface of the unheated slab	5F
Wind Velocity	15 mph

The coefficients of heat transmission and infiltration that were used for the various types of construction employed were independently calculated or, where possible, taken directly from tables in standard references.

A total heat loss from the building of 56,500 Btu per hr was established; 85% of this loss was through the exterior walls and the remaining 15% through the roof and the floor. The loss through the walls was further

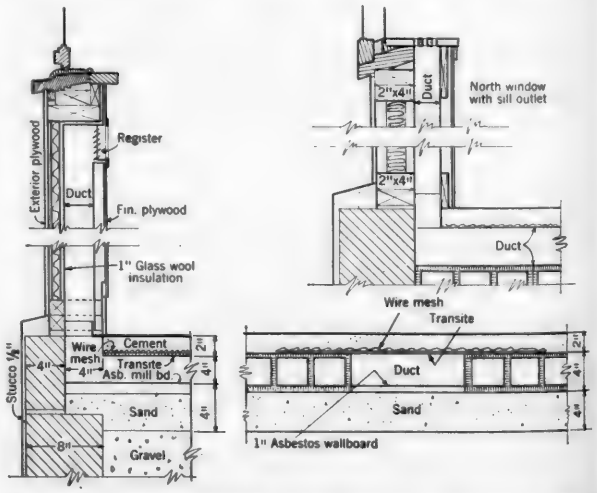

Fig. 2. Sections through floor and window sill supply ducts.

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broken down into infiltration loss, loss through the glass and loss through the plywood construction, so that the total loss may be expressed as follows:

Walls	40%	
Glass	25%	
Infiltration	20%	
		85%
Roof	11%	
Floor	4%	
		15%
		100%

An air temperature of 110F at the registers was selected, and an air volume of approximately 900 cfm was calculated to provide 39,000 Btu per hr, sufficient to overcome all the heat-loss through the glass and from infiltration, as well as most of the loss through the plywood construction. Duct sizes were estimated from this volume by the friction pressure loss method, using a velocity of 950 fpm in the main supply duct. This velocity was determined by what the designer considered to be the maximum size allowable for this duct, namely 4 x 44 inches. The 4 inch dimension was fixed by the thickness of the hollow-tile and the 44-inch dimension by the recommended ratio of 1:10 between the short and the long sides of the duct. Using 950 fpm as the maximum velocity, the minimum velocity in the branches was calculated to be 400 fpm.

The estimated duct sizes were then studied for their adaptability to a grid of 12 x 12 tiles and found wanting. Taking economy and ease of construction into consideration, it was evident that a standard size for the branches would be better than a variety of sizes adhering rigidly to those estimated, some of which were as small as 4 x 4 inches. It was also evident that a small duct, or channel, would have little effect as a heating panel, while a wider channel would not only present more heated surface, but would help to reduce the somewhat excessive velocity of 400 fpm.

Accordingly, a standard width of 10 inches was selected for most of the branches; this width proved to fit both the grid and the dimensions of the building best of all and to cause a minimum of tile cutting. However, in order to apportion the air volume according to the estimated duct sizes, sections of Transite pipe were placed at the junctures of the branches and the main supply to constrict the openings to the calculated size. Pieces of flat Transite, as baffles to direct the air-flow, were also placed in the main supply channel.

Having departed from the estimated sizes insofar as the branch channels were concerned, it seemed equally logical to adapt the m. in supply channel to the tile grid and the dimensions of the house plan and, ultimately, to the design of the furnace. Therefore, the 44-inch dimension of the main supply was abandoned for one of 36 inches as a maximum; and the furnace outlet was later given a width of 28 inches. These smaller dimensions serve to increase the velocity in the main supply channel, but since it is in turn decreased by the larger sizes of the branch channels, the end result is a low velocity at the registers.

Having established the sizes of the channels, it was next necessary to calculate the heat-loss from them: not only the loss to the ground, but the welcome "loss" to the floor slab. What seemed to be a reasonable method involved determination of the air temperature drop in the given length of channel by determination of the heat loss from the channel.

$$H = 60 \text{ sb VD} \times .24 \ (t_i - t_y).$$

$$H = L \left[U_s(2s + b) + U_b b \right] \left[\left(\frac{t_i + t_y}{2} \right) - t_o \right]$$

t_i = temperature of air entering the channel (180F at the bonnet).
t_y = temperature of air leaving the channel (110F at the registers).
t_o = temperature surrounding the channel (57F).
s = side of channel, in feet.
b = top or bottom of channel, in feet.
D = density of air, .075 lb per cu ft.
V = velocity of air, fpm.
L = length of channel, in feet.
U_s = coefficient of heat transmission for top and sides of channel, combined, Btu per (hr) (sq ft) (F).
U_b = coefficient of heat transmission for bottom of channel, Btu per (hr) (sq ft) (F).
H = heat-loss from channel, Btu per hour.
.24 = specific heat of air at constant pressure, Btu per (lb) (F).

The coefficients of heat transmission for the top, bottom and sides of the channels were computed from the conductivities of the various materials and from their surface conductances at the appropriate air velocities. The coefficients for the top and the sides were combined, in the ratio of dimension, to give a single value, U_s. Although such a combination does not give a strictly accurate answer to the question of the welcome loss to the floor slab, it seemed accurate enough for the purpose and greatly simplified the calculations. Since the slab was not being calculated primarily as a radiant panel, it was enough to know the loss to it, or if you like, the gain by it. For the loss calculations an ambient temperature of 57F around the channels was determined. There was no attempt made to calculate the actual surface temperature of the slab above the channels, because the designer was satisfied, by previous experiment, that the 2-inch concrete roof was sufficient to prevent excessive temperatures that would lead to damage or discomfort.

Calculations showed that 80% of the heat-loss from the channels would be lost through the top and the sides and 20% lost through the bottom. The loss through the top and sides can again be divided according to the top-to-sides ratio to give a sufficiently accurate estimate of the direct gain to the floor surface. Of the heat lost through

the sides of the channels, it is reasonable to suppose that it, in turn, dissipates itself through the hollow slab in approximately the same ratio of 1 part being lost to the ground and the other 4 constituting an ultimate gain to the building.

The end result of the calculations was the establishment of a heating load of 60,000 Btu, 73% of which was carried by the registers and 27% by the floor slab; the extra 3,500 Btu (over the heat-loss of 56,500 Btu) was considered a necessary safety factor because of the experimental nature of the installation. Comparing the division of the heating load with the distribution of the heat-loss, it is clear that while the registers account for all the loss through the glass and from infiltration, they need the help of the floor to offset the loss through the walls themselves. Therefore, in this division of the load, the floor not only accounts for the loss through the roof and through its own unheated portions, but for 30% of the loss through the walls.

The registers were selected to provide low velocity and as great a width of air-column as practicable, the intention being to furnish an air-curtain that would drift upward in front of the windows rather than throw itself outward into the room. Adjustable registers were selected as giving the most positive direction to the air-flow as well as the most positive control. The grilles in the window-stool of the living room were designed with the same qualities in mind; they are 3 inches wide and 16 inches long and are controlled by dampers in the vertical metal ducts which connect them to the floor-channels.

Control

General control of the air-flow was seriously considered and finally discarded as impracticable. The use of dampers in the floor-channels would have been the only feasible method and these could have been operated conveniently only by handles projecting above the floor. The hazard of such obstructions ruled them out, and the dampers went with them. The designer believed that adequate, if somewhat inconvenient, control could be realized by adjustment of the registers, alone. This in fact is the case and the system is found to be very responsive to such a rough-and-ready method. It proves, also, to be far less inconvenient than had been supposed and its idiosyncracies are easily mastered.

A day-night thermostat provides the only other type of control. This is located, close to the return-grille, in the passage leading from the living room to the kitchen and the entry. A daytime setting of 65F and a nighttime setting of 55F have been found to give the best results.

The heater selected was a standard forced-warm-air heater of 70,000 Btu per hr. capacity and delivers 880 cfm at a bonnet temperature of 180F; it is fired with oil and is equipped with a humidifier and all the usual safety controls. Unlike many furnaces manufactured today with floor outlets, its outlet is at the top; therefore a metal duct had to be provided to carry the air down to the floor.

The system in operation is satisfactory in every way. Because the house was occupied immediately upon completion and before the heating season began, there was no opportunity to make the series of detailed performance tests which the designer had had in mind. He had to be satisfied with a few spot-tests and with the findings of the occupants themselves, who after all are the best judges of whether or not the system is successful in keeping them comfortable. These findings include those of the client, Mr. Schulz, who took a more or less scientific interest in the performance, as well as those of two succeeding families who were more general in their appraisals; happily, they confirm most of the designer's presumptions.

The warm air delivered through the registers holds closely enough to its design temperature of 110F to effectively counter the heat-loss at the windows; it also enables one to sit near the windows, which is rarely possible in this lattitude in a house heated only by a radiant floor. The floor slab delivers all the heat expected of it and, in a sense, more: it acts as a reservoir that not only helps to maintain an even comfort condition by releasing its heat in a relatively constant manner, but that offsets the flash-action of the oilburner, the only bad feature of this type of heater for warm air heating. Although the radiant effect of the slab has not been calculated, it is evident that this effect has a great deal to do with the reservoir action; for, without taking this effect into consideration, the slab's calculated share of the heating load is certainly not enough to produce the comfort which it renders, particularly in periods of slight furnace activity. In the discussion of this action, which follows, the radiant effect must be kept in mind as an important feature of the slab's performance for both comfort and economy.

Surface Temperature

There are relatively wide variations in the surface temperature of the slab and, technically speaking, the heat distribution over the surface is far from ideal for that reason. However, these variations are apparent only to the bare hand and are therefore not extreme enough to affect one's comfort. It was not possible to take what the designer considered to be accurate temperature readings, but generally speaking, in the middle of the heating season, the heated areas of the slab range from a low of about 75F at the outer extremities of the channels, just before the vertical ducts to the registers, to a high of about 110° above the furnace outlet. This latter temperature is excessive, of course, and could have been prevented by more insulation in the roof of the channel, but since it occurs in the southeast corner of the living room, it leads to no discomfort. It is apparent over an area of no more than a square-foot and the drop in temperature outside this area is quite marked, falling to 90F within a radius of 2 ft.; this rather sharp drop would seem to be caused by the rapid abstraction of more than half of the total air volume by the branch channels to the entry, the kitchen and the living room. The temperature over the main supply channel drops slowly to a minimum of 85F in the bath room where, since it is most apparent just in front of the bathtub, it is a source of great pleasure to the bathers. With the exception of the relatively short branch to the entry, which manages to hold the slab temperature close to 85F, the branches allow more rapid temperature-drops than does the main supply; this is attributable, in large measure, to the low velocity in the branches.

The unheated areas of the slab-surface have not been found to drop below 65F. The temperatures of those areas between the channels of the living room show a drop of 5F to 10F from the temperatures over the channels themselves; and so far as one can judge, the effect of any of the channels can be felt for about 2 ft. on either side. However, since the channels were laid out with both walking areas and standing areas in mind, there is no part of the

unheated floor which has brought forth complaints of cold feet; nor, for that matter, have there been any complaints of hot feet.

The reservoir character of the slab is most apparent in the operation of the furnace. Because of its ability to store heat and to dole it out at a surprisingly uniform rate, the slab, once heated, requires very little additional heat to keep it up to the mark. During a normal winter's day of 40F air temperature and 15 mph wind, the heater is turned on by the day-thermostat at 7:00 A.M. and runs for approximately twenty minutes before the thermostat is satisfied and shuts it off. If the sun is relatively strong, the thermostat will not call for heat again until nearly noon; if the sky is overcast it will call for it between 9:00 and 10:00. In either case, fifteen minutes of heater operation is sufficient to replenish the reservoir until midafternoon, if there is strong sun, or until noon, if there is an overcast. The midafternoon call seems to be inevitable, sun or no sun, and the same may be said for the sunset call, which often follows in less than 3 hours. After this there is a fairly regular 2-hour sequence until the night-thermostat takes over at midnight. If there is a sharp drop in temperature during the night, the heater will be turned on once or twice, but under ordinary conditions the reservoir usually carries over until morning. Almost invariably the daytime calls are satisfied by fifteen minutes of heater operation; during the evening twenty to thirty minutes are required. The sequences of this typical daily cycle are, of course, increased by low temperatures and high wind velocities and decreased by their opposites. The reservoir demonstrates its merit by helping to take up the inevitable time-lag of the thermostat and, for this reason, there are no periods of discomfort while the thermostat is catching up with a sudden drop in temperature or a sudden rise in wind velocity.

This characteristic of a radiant slab has often been criticized, however, for having a time-lag of its own, in responsiveness, which leads to overheating. This would seem to be true chiefly of installations that are subject to a good deal of sunload, such as those in buildings with large southern exposures of glass. In the particular installation under discussion the time-lag has never been a factor contributing to discomfort; on the contrary, by offsetting the flash-action of the oil-burner and imparting a certain stability to the heat supply, it has had the opposite effect. It is quite possible that a sunload of more than ordinary proportions would lead to overheating in this installation as well, and that the rather unusual exposure of the site has contributed to the success of the system.

The reservoir has also been criticized for its slowness in heating up. The criticism is perfectly valid in the sense that a radiant slab does take a comparatively long time to warm itself; but this would appear to be a rather minor fault. In the Schulz house about an hour is required to create reasonable comfort from a cold start. But how many cold starts are there in the average home? The heat is usually turned on in October, when a cold start in mild weather is not really a cold start at all, and is turned off in April. Most of the cold starts in midwinter would seem to occur when one has just returned from Florida, or has opened a cottage for the weekend. Since it would be difficult to have the two qualities of a reservoir and instantaneous heat in the same system, the slowness in heating up seems to be a small price to pay for even, comfortable warmth and economical operation.

The factor of cost, always an important one, becomes equally important in this type of installation, for here the cost is low. The floor construction of hollow-tile on a bed of sand and gravel, topped with a 2″ concrete slab, costs no more than the conventional construction of a double-floor on wood joists over a crawl-space. In the installation in Mill Neck the low cost was partly due to the use of common-labor for the laying of the hollow-tile. In a highly-unionized district the masons undoubtedly would claim this job and thus raise the cost of the floor over that of a wooden one. However, when one considers that the cost of metal ducts would have to be added to that of the wooden floor, the higher wage paid the masons would not even then make the masonry construction uneconomical. With common-labor laying the tile, the construction is very economical indeed: one gets a floor and a duct system for the price of a wooden floor, alone.

In common with the more orthodox systems of radiant heating, the split-system—or this particular split-system—saves fuel. Through calculation of the fuel consumption if the house were conventionally heated, the designer came to the conclusion that the split-system effected a fuel-saving of about 25%. Short of building two houses exactly alike in the same location, there is no certain way of establishing definite proof of this saving; but its approximation to savings effected by the more orthodox radiant systems gives reason to believe that it isn't far wrong.

Summer Operation

A word about the summer operation of the system has been left to the end, not because this phase is considered unimportant but because it is, in effect, no more than the uncalculated but effective inverse of the winter phase, and can only be described in even more general terms than the latter. For the system was designed for heating and no compromises were made in the design to adapt it for cooling. Nevertheless, although the location of the house does not make its cooling of primary importance, the designer felt that some cooling effect could be produced if it were needed, by the system even as designed. He was sure that summer air blown under the floor would lose enough of its heat to the cooler ground to produce this effect; and he counted on the air-motion from the registers to add to what he felt would be a creditable comfort on particularly hot days. Accordingly, at the time of installation the furnace-blower was arranged for independent operation, a damper was provided on the return-air duct to permit its complete closing, and the fresh-air intake was sized for the full capacity of the blower at a velocity of less than 900 fpm.

In the first summer of operation the effectiveness of the system was demonstrated. Although, from the fresh-air intake to the registers, the temperature of the air dropped no more than 5°, this relative coolness, coupled with air-motion throughout the house, made the difference between ease and discomfort. The general procedure in the summer is to close the return-air duct entirely and to rely upon the clerestory windows for exhaustion of the warm air; since these windows are at the highest point of the house they perform their function well enough and obviate the necessity of an exhaust fan. Neither a dehumidifier nor a cooling-coil has been added to the system, but it is evident that with them a much greater cooling effect could be obtained.

Louis Blendermann on

PIPING

and PLUMBING

Simplifying Field Survey Data

INCLUDED in the scope of design work for the engineer, are the alterations or additions to existing buildings. This type of work has its particular difficulties since it requires that a visit be made to the site and a thorough examination completed of the existing facilities in the building. This provides information regarding the location, condition and capacity of these building facilities. The field survey is made somewhat easier if record plans of the original design are available, but frequently they are not, and more often the facilities have been altered considerably since the initial installation.

If the project is located nearby, then frequent visits can be made although they are time-consuming. However, when the work is a good distance away, as much information as possible about the existing conditions must be obtained during one visit. It is neither practical nor economical to make extra visits to obtain data overlooked on a previous call.

Manner of Making Survey

There are numerous methods that may be used in making a field survey. Each engineer has a particular method that he follows to obtain and record the needed information. For those, however, who have not made a survey and who may wish to adopt a practical method for recording the findings on such a survey, a suggested record form is offered.

This form covers all the systems at the project that may be affected by the alteration or addition work. It is only necessary to fill in the information for each pertinent item listed on the form and a record will result of all conditions, relating to the existing facilities and equipment.

Where sketches are called for on the form, it is good practice to attach to the back of the form, several sheets of cross section paper on which the sketches may be drawn. A careful sketch, well labeled, can illustrate the existing conditions or piping hook-up in a clearer manner than many words.

Plans of the proposed new work, usually taken to the site, spot the areas of proposed alterations and additions. Knowing such locations, it is possible to determine just which services will be affected, and as a result, more emphasis can be placed on the examination of these services.

During the visit to the site, much valuable information can be obtained from responsible men in the various city or private utility companies. When consulted with regard to the proposed project, they can supply from their records, many pertinent facts about the existing utilities serving the project. In addition, they will furnish first hand information on the exact requirements, concerning the particular utility over which they have jurisdiction. An important item, not to be forgotten, is the local plumbing code. This code may usually be obtained at the local City Hall, Department of Health or from the plumbing inspector.

Advantages of a Form

While there are many advantages in using a form for record purposes, two of the greatest benefits are covered.

When a survey is made of a rather large project, there is a tendency to wander through the building, taking notes of important items that are believed to have an effect on the design work. The items are recorded as found in each area of the building. Unfortunately however, the hours pass quickly during a survey and before one realizes, the day is over. The person making the survey, glances at his voluminous notes and decides that he surely must have gathered all the necessary facts. Once back in his office, he discovers that he overlooked important items and that he forgot to check others. He then wonders how he can best, without too much trouble, obtain the missing information.

By use of a form similar to that presented, all the basic facts are recorded and the engineer will be amazed at the amount of useful facts he has acquired. Should some additional information be necessary, he has the names and telephone numbers of the various utility departments and building custodian to contact for the necessary answers.

The second important advantage is that all the basic information is recorded. Should the design of the project be delayed for several months, as often happens, records in the files will be available when the work proceeds again. Also, during the course of design, doubts arise with reference to the size or condition of certain piping, the form can quicky clarify the picture. If the design is enlarged or extended in scope, these records will contain sufficient basic information to avoid an extra trip to the site.

In addition, if another engineer is called upon to complete the project without the aid of the person that made the survey, the completed form will be of great assistance.

Those who have experienced the difficulties of making a field survey will appreciate the value of the form offered. Services and utilities, other than those covered in this form, may be added with the pertinent questions to be

answered, arranged in a similar manner to that shown. Many engineers have similar forms that they have been following for some time with successful results. It is hoped that the form presented will be of help to the engineers and designers who have not formulated a definite pattern for obtaining and recording the results of their survey.

Later in this series of articles, other forms relating to the various phases of design proceedure will be presented.

PLUMBING—SURVEY FORM FOR ALTERATIONS AND ADDITIONS

Project

Name .....No. .....
Address .....
Telephone No. .....
Custodian's name .....

Cold Water Service

Size .....Street Pressure.....Location.....
Material.
(a) Copper .....
(b) Lead .....
(c) Corporation pipe .....
(d) Other material .....
Condition of service .....
Roof tank..... Size.....Pumps.....
Water Company.
(a) Name .....
(b) Telephone No. .....

Water Meter

Make .....Size .....Location.....
Sketch of hook-up .....

Cold Water Lines

Material.
(a) Copper .....
(b) Brass .....
(c) Galvanized .....
(d) Other material .....
Condition of piping .....
Are present mains and risers of sufficient size for new work? .....

Hot Water System

Hot water storage tank.
(a) Size .....Location .....
(b) Manufacturer .....
(c) Material .....
Other method of heating water .....
(Draw a sketch if necessary)
Temperature of hot water .....
Piping material.
(a) Copper .....
(b) Brass .....
(c) Galvanized .....
(d) Other material .....
Condition of piping .....
Are present mains and risers of sufficient size for new work? .....

Sanitary System

Size of house drain.....House sewer.....
Where do present lines discharge? .....
(a) Sanitary sewer.
(1) Size .....
(2) Location .....
(b) Septic tank system.
(1) Size of septic tank .....
(2) Size of tile field .....
(3) Location of both .....
(c) Elsewhere .....
If a sewage ejector exists—
(a) Manufacturer .....
(b) Size .....
(c) See nameplate for characteristics .....
(d) Location and piping hook-up .....
Are present soil and waste lines of sufficient size for new work? .....
Type of piping used .....
Sewer Department.
(a) Name .....
(b) Telephone No. .....
(c) Obtain Plumbing Code .....

Storm Water System

Where do present lines discharge?
(a) Storm sewer .....
(b) Combined sewer .....
(c) Curb .....
(d) Dry wells .....
(e) Elsewhere .....
Type of roof drains used .....
If a sump pump exists.
(a) Manufacturer .....
(b) Size .....
(c) See nameplate for characteristics .....
(d) Location and piping hook-up .....
Are present lines of sufficient size for the new work? .....
Type of piping used .....

Fire Standpipe System

Size of water service .....
Size of standpipe risers .....
Sketch of meter hook-up if any .....
Hose racks.
(a) Type .....Manufacturer .....
(b) Diameter of hose.....Length.....
(c) Hose thread requirements .....
(d) If adapters, type .....
Fire pump.....Booster pump.....
(a) Manufacturer .....
(b) Size .....Condition .....
(c) See nameplate for characteristics .....
(d) Sketch of hook-up.....Location.....
Fire Dept. or other authority.
(a) Name .....
(b) Telephone No. .....
(c) Obtain requirements .....
Are present mains and risers of sufficient size for new work? .....

Sprinkler System

Classification of present system .....
Size of water service .....
Type of present sprinkler heads .....
Spacing of heads .....
Fire Pump.
(a) Manufacturer .....
(b) Size .....
(c) See nameplate for characteristics .....
(d) Sketch of hook-up.....Location.....
Roof tank.
(a) Size .....
(b) Location .....
(c) Condition .....
Fire Department or other authority.
(a) Name .....
(b) Telephone No. .....
(c) Obtain requirements .....
Are present mains and branches of sufficient size for new work? .....

Gas System

Size of gas service .....
Pressure .....

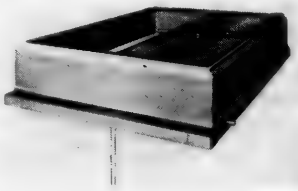
(Concluded on page 138)

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite page 126 for securing additional information on items described in this department.

Roof Unit Is Fire Valve

A roof unit for industrial buildings which opens quickly when excess interior heat occurs, has been added by The Swartwout Co., Cleveland, Ohio. Called a Fire Valve, it was developed to meet the newly recognized need for fast release of heat, gases and smoke in the event of fire. It has been observed that dense smoke frequently hides the flame source, preventing effective work by firemen.



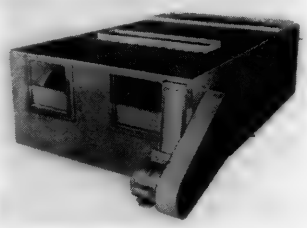
Each unit of the valve provides 46 square feet of free area opening when two large dampers drop, released by a fusible link device. Dampers can also be opened and closed by a loop chain when desirable to use the unit for extra ventilation in good weather. The unit is weatherproof when closed. Any number of fire valves can be installed on a roof to meet recommendations of fire and insurance authorities.

More information? Enter Item 1 on postcard, page 126

Heating and Ventilating Units

A new line of Herman Nelson heating-ventilating units, designed for installation in theaters, hospitals, offices, stores, showrooms, and industrial applications, is announced by American Air Filter Co., Inc., Louisville, Ky.

The new units, with capacities ranging from 1,200 to 15,000 cfm, can provide heating, ventilation, filtering, humidifying, or any combination of these functions. Models are available for installation on floors, ceilings, or walls.



Designed for flexibility in performance and installation, the units are available with any of ten different heating coils for nonfreeze, standard steam, and hot water service.

Sectional design of the units, with the completely rotatable fan sections, permits the selection of just the components required for a specific job. Sections offered include the heating coil section, 1 — 2 or — 3 centrifugal fan section, and humidifier. Casings are available for ceiling, wall, or inverted installation, and floor models are offered with both open and closed bases. Motors and V-belt drives can be installed on either side of the units.

To reduce maintenance costs, the Herman Nelson heating-ventilating units have been designed to be as nearly self-maintaining as possible. Low fan speeds are used in the units to assure lowest possible noise levels. Fans are double inlet, double width centrifugal wheels with forward curved blades, arranged for V-belt drives.

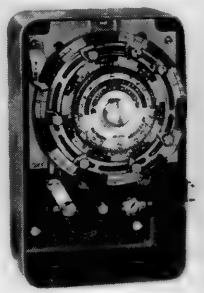
Steam (both standard and non-freeze) and hot water heating coils in the units are seamless copper tubing hydraulically expanded into aluminum fins. Steam coils are suitable for 200 psig pressure steam and 400 deg. F temperature. Coils for higher steam pressures are available on special order. Hot water coils, of the return bend type, have supply and return connections on the same end, and all coils are pitched in the casings of the units to allow for adequate drainage. Coil capacities range from 58,922 to 1,120,950 Btu per hr.

Both flat bank and angle type filter arrangements are available in the heating-ventilating units, with three types of filters offered. Temperature control may be achieved by throttling the steam supply or by means of the face and by-pass damper sections, regulating the air volume flowing over the heating coils of the units. Dampers can be controlled manually or automatically, and a mixing damper section is also offered for regulation of the mixture of outside and recirculated air flowing through the unit.

More information? Enter Item 2 on postcard, page 126

Air Conditioner Time Switch

New flexibility and compactness are combined in the revolutionary 3700 Series time switch introduced by Paragon Electric Co., Two Rivers, Wis. The new unit is designed to provide automatic control for all makes of window air conditioners. The time switch turns on the air conditioner before business hours.



The seven-day dial allows for different settings for each day as well as Sunday and holiday cutout. The switch can also be manually operated without disturbing the sequence of automatic operation. The complete flexibility stops unnecessary air conditioner operation.

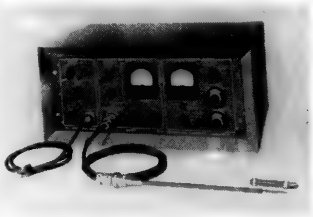
Two simple dials, which can be readjusted at any time, control the *on-off* schedule. The *on* time is adjustable on a 24-hour dial, within 15-minute periods. This allows the air conditioning unit to start early and make morning temperature, humidity and ventilation exactly right at the particular time best suited to individual preferences. The *off* time is set on the 7-day dial and may be set to shut off air conditioner at a different hour each day. Each tripper moves in self-retaining slots.

Suitable for use on air-conditioning units up to and including 1-ton capacity, the new series device is enclosed in a drawn steel case, finished in a neutral color to blend with modern decor. Designed to use existing cord set for easy installation.

More information? Enter Item 3 on postcard, page 126

Hot Wire Anemometer

An improved hot-wire anemometer of the constant-current type for the accurate measurement of average velocity, large velocity fluctuations and turbulence in fluid flow, is a new development of Flow Corp., Cambridge, Mass. Only required accessory equipment is an oscilloscope.



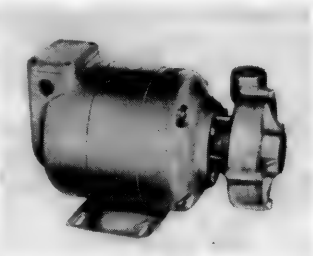
The Model HWB anemometer features include compact construction, systematized controls, and a wide selection of hot-wire probes for industrial and laboratory applications. The accuracy, sensitivity, and band width are said to surpass any laboratory or commercial anemometer reported to date.

Typical uses of this instrument are air conditioning flow studies, examination of ducting velocity profiles, and determination of turbulence intensity and spectra.

More information? Enter Item 4 on postcard, page 126

Bronze-Fitted Water Pump

The Model D-501 direct-connected, motor-driven Rumaco centrifugal pump, has been developed by The Ruthman Machinery Co., Cincinnati, Ohio.



This versatile circulating pump is adaptable to various air conditioning installations, including evaporative condensers, medium size cooling towers, fountains and swimming pools requiring up to 40 gpm at 30 foot head.

Unit is bronze fitted and will handle water and other liquids without danger of rust or corrosion even where used intermittently and during seasonable idle periods. It is equipped with an improved type self adjusting seal, and is furnished with either ¼, ½ or ¾ hp motor.

More information? Enter Item 5 on postcard, page 126

Cooling System for Conversion

A new residential cooling unit, the Convert-to-Cool, has been brought out by Typhoon Air Conditioning Co., Inc., Brooklyn, N. Y. The unit is described as a low-cost cooling unit for converting forced warm air systems to year-round air conditioning.

The system comprises two separate units, the cooling coil unit, which is normally installed in the ductwork right on top of the furnace, and the air-cooled condensing unit, which can be placed anywhere outside the living area, in a utility room, breezeway, basement, garage, or attic, or outside the house. The condensing unit includes a hermetic refrigeration compressor and an air-cooled condenser.

Cost of the system to the consumer is said to be considerably less than the cost of other methods of adding cooling to existing heating plants. The air-cooled feature of this equipment is also expected to be an important feature in selling to home owners, since it will eliminate water supply and drainage problems and extra plumbing costs, and will assure operation even during water shortages.

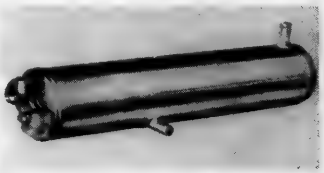
A feature of the system is the large condenser coil surface area, which increases the efficiency of the system and assures cooling even during the hottest weather. The fan opening in the condensing unit is equipped with a wire grille to protect children and pets, and rain hoods are available for both the fan opening and the air-cooled coil opening for outside application. Generally, a concrete slab will be used for a base for the condensing unit if located outside.

In addition to this air-cooled system, the company plans to introduce several water-cooled models in 3 and 5 hp. capacities. One model will also include a blower section for homes using steam or hot water heat.

More information? Enter Item 6 on postcard, page 126

Freon Condensers

A new line of ASME constructed and stamped extended surface Freon condensers are announced by Bell & Gossett Co., Morton Grove, Ill.



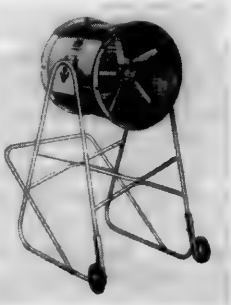
The new line of condensers consists of two styles of units. The Model CFG shell and coil condensers are designed to fill the need for a low cost condenser in small tonnage installations. It is available from factory stock in 2, 3, 5, 7½ and 10 ton sizes.

The Model CRF condenser is a straight tube unit with removable heads. This design, constructed and stamped in accordance with the Unfired Pressure Vessel Code, is also available from factory stock in 2 through 25 ton sizes.

More information? Enter Item 7 on postcard, page 126

Portable Mancooling Fan

A portable mancooler fan is one of the models added to the new line of direct drive fans made by M & E Mfg. Co., Indianapolis, Ind. It is designed to cool factory personnel by having the air move over them when working in areas of high temperatures. Application for this model is also made for accelerating the air drying of many manufactured products. Spot exhausting of steam, smoke and fumes created by temporary conditions is another application.



Units are available in diameter sizes of 24 to 48 inches, air capacities from 4,360 to 32,400 cfm.

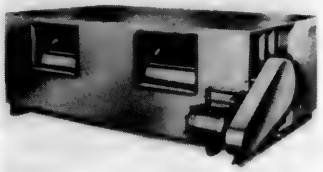
Complete specifications are given in Bulletin 500.

More information? Enter Item 8 on postcard, page 126

New Conditioning Unit Line

A complete new line of Climate Changers—factory-built air conditioning units—is introduced by The Trane Co., La Crosse, Wis.

The line is complete with capacity range of 600 to 29,000 cfm. It includes both horizontal and vertical models each in ten sizes. The horizontal models can be suspended from the ceiling or installed on a platform; vertical models can be floor-mounted. It is possible to include or omit any combination of the six air conditioning phases without interfering with the basic design in any way.



All units in the new line have a sectional casing construction which provides additional strength and sturdiness along with ease of installation. Units can be disassembled at point of installation and with little effort moved through an ordinary 36 inch door. This is true of all units with the exception of the largest which requires a door with a 40 inch opening.

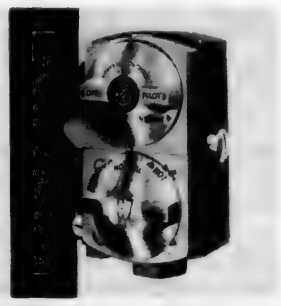
The units can be equipped with one of three different heating coils and one of five various cooling coils. All coils are constructed with Delta-Flo fins for increased heat transfer efficiency. The variety of coils available permits all practical combinations of heating, cooling, humidification and dehumidification. Horizontal air flow arrangement in vertical units prevents moisture hold-up in coils.

The units have face and by-pass dampers; by-pass is externally mounted for modulating control. Three types of humidifiers can be selected. They are water spray, steam pan and steam grid. Each humidifier has its own specific application.

More information? Enter Item 9 on postcard, page 126

New Water Heater Control

A new water heater control, the G-7, introduced by General Controls Co., Glendale, Calif., with a streamlined twin-dial model, and which offers both an ultra-modern appearance and new simplicity of operation.



This new thermostatic control is a complete departure from the traditionally functional appearance of heater controls. The mechanism is contained in a compact aluminum case which fits against the water heater with a minimum of protrusion, and all control functions are incorporated in the two satin chrome dials. There are no levers or buttons to manipulate in adjusting or re-lighting the heater.

The upper dial incorporates on-and-off controls, plus simplified reset and re-lighting of the pilot using the company's rotational reset feature which eliminates the conventional reset button.

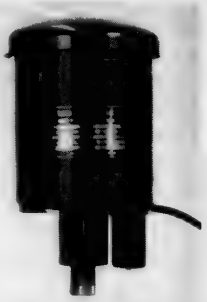
The lower dial provides for a complete range of temperature selection, with easy readability from a standing position.

Ease of servicing is another feature of the G-7. The simple design has a minimum of parts, the control head can be removed quickly from the shank.

More information? Enter Item 10 on postcard, page 126

Lightweight Sump Pump Motor

A sump-pump motor, 25 per cent lighter than previous models, is announced by General Electric Co., Schenectady, N. Y. The motor has aluminum end-shields, cast aluminum rotor, and welded steel shell for maximum strength. Formex insulated windings plus slot and between-phase insulation of polyester film provide extra protection against humidity and cellar dampness. The entire stator assembly is protected by a dip-coat of Glyptal water- and heat-resistant varnish.



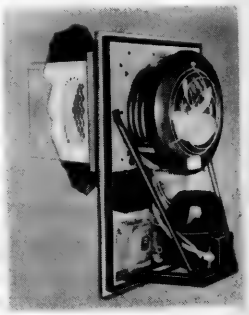
Meeting NEMA standards for sump pumps and cellar drainers, the open dripproof motor, type KH (split phase), is equipped with drip-cover, built-in switch, and bottom flange for direct mounting. Weight or float switches are optional.

Rated at ⅓ hp, the motor is available in 50 cycle-1425 rpm and 60 cycle-1725 rpm models, and 115/230 v.

More information? Enter Item 11 on postcard, page 126

Line Of Outboard Cooler Units

Three deavy duty outboard type refrigeration units for walk-in coolers are announced by Taylor-Burch Refrigeration Products, Jackson, Mich. According to the manufacturer, the 1-ton (or 1 hp) Model 100 will handle a 12 x 12 x 7½-ft cooler under normal conditions and maintain a 35 deg F temperature. Temperature settings can be changed if desired. The Model 50, ½-ton unit is designed for a 6 x 8 x 7½-ft box and the Model 75, ¾-ton for a cooler measuring 8 x 10 x 7½-ft or equivalent. For larger coolers, multiple units may be used.

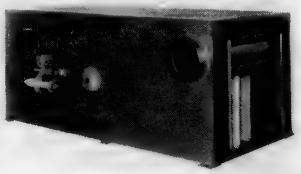


For the 1-ton unit, a hole 20¼ inches square is cut in the side wall of the box. The unit is then set through the hole and fastened with four screws. All that remains is to hook up the necessary power and throw the switch. The entire installation can be completed in a few minutes. Since no knowledge of refrigeration is required, the installation can be made by the owner. All three models are air-cooled which eliminates the necessity for water connections, but the Model 100 is furnished with a water condenser if desired.

More information? Enter Item 12 on postcard, page 126

Commercial Oil Duct Heater

The line of OverHead Heaters, Inc., Detroit, Mich., has been expanded by addition of an oil-fired duct heater for use with central air conditioning systems in super markets, stores, commercial and industrial applications. The new duct heater is equipped with air intake louvers which balance the distribution of air over the heat exchanger, as well as giving correct air velocity. This eliminates past problems of excessive heat in the heat exchanger. It has been pre-tested through two years of installations in every type of commercial and industrial applications.



The heater is available in 200,000, 300,000 and 400,000 Btu per hour output at the bonnet. Units can be furnished with burners either on the right or left hand side for additional economy of installation.

The heater is of heavy gage construction and finished in an attractive crackle gray. It is designed for installation in any convenient location and suspended from ceiling joists.

More information? Enter Item 13 on postcard, page 126

Custom Made Fan Guards

A complete line of fan guards, custom made to specifications, is offered in resistance welded wire by Peerless Wire Goods Company, Inc., Lafayette, Ind. Available either flat or formed, these guards are offered in a variety of finishes from raw metal to plate or organic finishes and polyvinyl coatings. Sizes of wire available to ½ inch diameter.

More information? Enter Item 14 on postcard, page 126

Redesigned Baseboard

Years of experience with installation and operation of National Art Baseboard in thousands of applications influenced a complete redesign of this heating product by The National Radiator Co., Johnstown, Pa.

An improvement in the redesigned unit is the achieving of a higher IBR forced circulation hot water rating. The standard capacity heating element has a heat emission of 300 Btu per hour per lineal foot with water at 150 deg F, up to 660 Btu per hour per foot emission with water at 220 deg F. The high capacity heating element has a range of from 350 to 820 Btu per hour in the same category.

The heating elements are fabricated of ¾ inch nominal copper tubes 8 feet long. On them 2⅛ x 3⅛ inch aluminum fins are mechanically bonded. There are 48 fins per foot in the high capacity element, and approximately 31 fins per foot in the standard model. In both elements, one end of the copper tube is swaged to eliminate the use of connectors.

The baseboard continues to be available in two types. A flush model (Type BF) is designed for installation against plaster in place of conventional baseboard. The recessed model (Type BR) replaces customary baseboard and is recessed under the plaster . . . generally installed when a house is being built.

Hanger brackets also have been changed. Expansion and contraction noises are said to have been minimized by hanging the heating elements on wire support hooks, which are suspended from the top of the hanger brackets. Instead of having a two-piece back panel, the newly designed baseboard includes a one-piece back panel with a positioning ridge. This is to expedite quick and accurate positioning of the hanger brackets.

More information? Enter Item 15 on postcard, page 126

3-Feature Control for Schools

A three-featured heating control system for schools that gives teachers control over temperatures in their own classrooms and, at the same time, permits the principal to maintain push-button supervision over conditions in all classrooms without leaving his office, has been developed by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. The system also doubles as a fire alarm.

Thermostats in each classroom are wired to a master control monitoring panel installed in the principal's office or at some other convenient location in the building. By pressing a button, he can read the temperature in any classroom at any time (see photo).

The thermostat is an adaptation of the company's individual classroom control instrument. However, it also includes a sensitive fire-detecting element and relay which sounds an alarm and indicates on the master control panel the exact location of a blaze anywhere in the building.

The control system can also include fire-detecting elements for closets, paint rooms, storage areas and other parts of the building where thermostats are not installed.

The new system is custom designed to permit the principal and teachers to work together in using properly controlled temperatures as an aid to learning. With a thermostat in each classroom the teacher can adjust temperatures according to varying teaching activities. The master control board keeps the principal informed.

Extra mental stress causes the body to build up internal heat, which tends to dull the pupil's mental processes and impair his learning efficiency unless compensated for by lower classroom temperatures.

The new equipment can be installed with most existing pneumatic temperature control systems in which individual classroom thermostats are used.

More information? Enter Item 16 on postcard, page 126

Foil Tape for Insulating Batts

An aluminum foil pressure-sensitive tape for industrial sealing, splicing, conduction, and heat reflection jobs is announced by Minnesota Mining and Mfg. Co., St. Paul, Minn. The new tape, Scotch brand aluminum foil tape No. 425, is made with a dead-soft aluminum foil backing coated with a high-tack thermosetting type adhesive. Total thickness is 5.25 mils.

The tape is unaffected by extreme humidity conditions and features excellent heat reflection, weathering, moisture resistance, and conductivity characteristics. It also meets government specification dealing with aluminum foil pressure-sensitive tape for ammunition.

Test users report that the tape's largest single potential appears to be in sealing butt splices of foil-backed insulation batts. In addition, it has been found valuable for sealing overlap joints of metal sheets, ideal for a reflective covering against radiant heat, and excellent for conduction of electric current.

The tape is available in ¼- to 24-inch widths on 60 yard rolls.

More information? Enter Item 17 on postcard, page 126

Commercial Air Conditioner

A free-standing, self-contained summer air conditioner cooling unit for use in offices, restaurants, taverns, stores and other commercial establishments, is introduced by Janitrol Div., Surface Combustion Corp., Columbus, Ohio. The unit, the Janitrol Type F commercial cooling unit, is one of a series of cooling conditioners first announced early in 1954.

The new conditioner is a commercial counterpart to the Janitrol residential summer air conditioners. Available in 2, 3 and 5-ton cooling capacity conditioners, the units have additional features designed for commercial use.

Janitrol engineers have added an air intake and glass fiber filter assembly at the base of the commercial unit. When the air has been taken into the conditioner it is filtered to remove dust, pollen and bacteria and cooled before it is distributed into the surrounding area. Adjustable louvers in the outlet diffuser at the top of the unit direct air both vertically and horizontally into selected spots for balanced comfort during hot summer months.

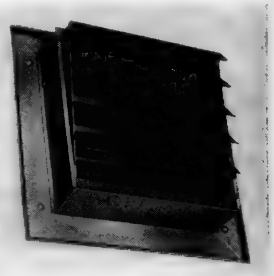
The compact unit is enclosed in an attractive steel cabinet finished in a new neutral blue-gray tone that blends harmoniously with every decorative scheme. The cabinet stands 88½ inches high, 26 inches deep and varies in width from 26½ to 40½ inches, depending on the size of the cooling unit. Heavy fiberglass acoustical material further sound-deadens an already exceptionally quiet commercial cooling conditioner. The fiberglass also serves as a heat insulation and helps prevent moisture condensation on the cabinet.

Incorporated in the design is a one-piece chassis to facilitate installation, servicing and repairs. The hermetically-sealed refrigeration chassis can be quickly removed from the cabinet and replaced. An outstanding feature of the 5-ton unit is a two-step arrangement which permits the 3-ton section to operate initially, providing comfort by dehumidification. When peak load demands maximum cooling, the 2-ton section cuts in automatically. The hermetic refrigeration assembly compressor unit used in the cooling system carries a five year warranty.

More information? Enter Item 18 on postcard, page 126

Air Proportioning Grille

The APV-QO series grille is announced by Air-Factors, Inc., Monrovia, Calif. It is provided with adjustable scoop type air proportioning vanes designed to balance the air volume for a given supply outlet. The quick opening feature provides for extracting air without the scoop entering the main duct over 2½ inches insuring reduction of air velocity and even distribution over face of outlet with full shut-off possible.

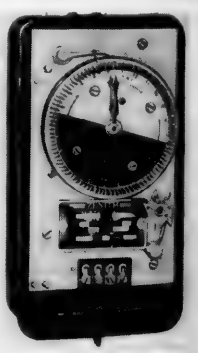


Air volume control is provided separately or attached directly to any of the company's ceiling outlet or air diffuser. All adjustments to the air volume may be accomplished after installation without removing the ceiling diffuser.

More information? Enter Item 19 on postcard, page 126

24-Hour Time Switch

A multiple operation time switch designed to provide easy adjustment for complete 24-hour schedule by sliding the self-contained, non-removable trip levers in or out on a dial scaled in 15-minute graduations, is a new product of Zenith Electric Co., Chicago, Ill. As many as 48 *on* and 48 *off* operations can be automatically repeated for every 24-hour period.



Intermittent daily operations with night shutdown for operating heating, ventilating, and air conditioning systems, stokers, oil and gas burners are a few typical applications.

Two models are available, with or without calendar device to cut out non-working days. All models are powered by heavy duty, self-starting, self-lubricating, synchronous industrial motor.

More information? Enter Item 20 on postcard, page 126

New Baseboard Radiator Line

A new line of Crestline baseboard radiators is announced by Crest Mfg. Co., Newton, Mass. It can be installed using the conventional one-pipe forced hot water system or the series loop installation. Either one or two cores of heating element can be used. With the single core installation the output at 180 deg water temperature is 3⅓ square feet of radiation per lineal foot. Using the double core increases the output to 5¼ square feet of radiation per lineal foot.

The line has been designed especially for ease of installation, service and appearance. The over-all height from the finished floor is 8⅞ inches, and when not recessed it extends just 2½ inches from the wall. Each individual section is designed so that it snaps firmly into place. This feature eliminates the necessity of screws and saves valuable time. The back panel, top moulding and cover brackets in one complete unit is another time saver.

More information? Enter Item 21 on postcard, page 126

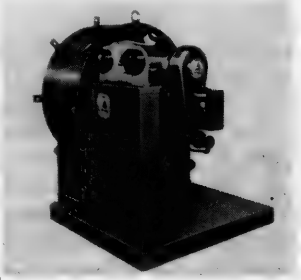
Tape Type Flange Sealer

A sealing tape or bead with a string reinforcement core, furnished in easy-to-use tape form, is announced by Presstite Engineering Co., St. Louis, Mo. The flexible, moldable tape, No. 161.1, will not sag or string out. It has excellent adhesion on both sides, making it ideal for sealing under metal trim, between aluminum lap joints, under metal flanges, and for setting and sealing glass in metal frames or channels.

More information? Enter Item 22 on postcard, page 126

Packaged Combustion System

A packaged combustion system has been developed by Preferred Utilities Mfg. Corp., New York, N. Y., to meet the heating and power needs of industrial and commercial plants capable of making oil burner or oil and gas burner installations on new or existing boilers with their own maintenance crew.



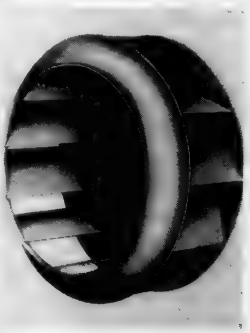
Known as the Thermopak plan, it comprises a combustion unit with all necessary controls and accessories, factory assembled and tested, as well as a complete survey of the heating plant leading to a custom designed package to meet specific requirements, with detailed layout drawings and specifications for the combustion chamber, oil and gas piping, electrical work, draft control, and other components. The unit, with all necessary controls and accessories, converts any standard fire tube or water tube boiler to automatic oil-fired or combination oil and gas fired operation, using heavy fuel oil requiring preheating.

The packaged combustion unit is accompanied by complete instructions and drawings for installation, connections and operation, with a factory engineer to start up, adjust and instruct in the successful operation of the system.

More information? Enter Item 23 on postcard, page 126

Blower Features New Wheel

A new line of backward curve blowers is introduced by The Peerless Electric Co., Fan and Blower Div., Warren, Ohio. The blowers round out the company's line and follow the KE-9 kitchen hood exhauster previously introduced.



The backward curve blower is being manufactured in all NAFM recommended sizes from 12½- to 36½-inch. It has self-limiting horsepower characteristics and meets all performance standards and requirements.

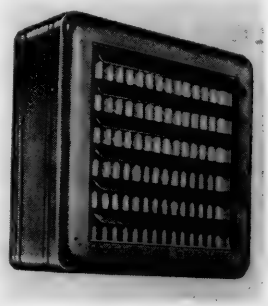
Top feature of the new blower is the dynamically balanced wheel. It permits smooth, quiet entry, passage and exit of air. It is designed with a matching spun cone. There is nothing in the air stream. A heavy cast-iron hub provides total support and assures maximum balance throughout blower life.

Housings are available for outdoor installations. The motors are job matched and were designed specifically for these blowers.

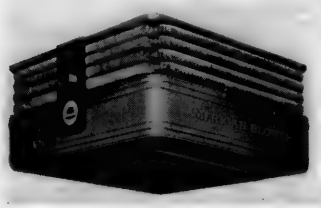
More information? Enter Item 24 on postcard, page 126

Steam and Water Unit Heaters

A new and completely redesigned line of unit heaters for steam or hot water operation, is announced by American Blower Corp., Detroit, Mich.



The heaters are built in both the horizontal (top view) and vertical (bottom view) types in a wide range of sizes for any industrial or commercial application. They operate quietly and are tested and rated in accordance with standard test codes adopted jointly by the Industrial Unit Heater Association and the ASHVE.



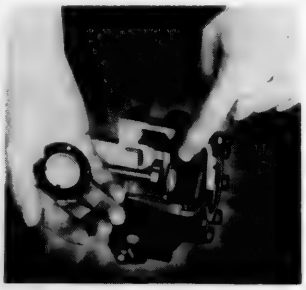
The new unit heaters, through improved manufacturing methods and design, are priced to meet today's competitive market without sacrificing any of the high standards of quality for which the company is known.

Bulletin 7517 is available.

More information? Enter Item 25 on postcard, page 126

Anti-Hum Diaphragm

The development of a new anti-hum diaphragm that is said to make fuel unit operation even quieter than before, is announced by Sundstrand Machine Tool Co., Rockford, Ill. This diaphragm is constructed of acid-and-oil-resistant nylon and acts as a pillow to cushion the oil as it is being pumped into the strainer chamber.



Two pieces of nylon are molded and fused together, forming an air chamber between. When the oil is pumped, the diaphragm has a breathing effect that changes tank hum into smooth, quiet operation.

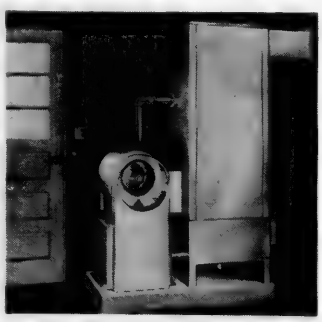
Its design, it is said, in no way restricts the flow of oil so there is no danger of starving the fuel unit.

In the company's fuel units currently being produced, the diaphragm is simply clipped to the end of the gear housing. It is now being furnished in both single- and two-stage units, Models J and H. In older models, the diaphragm can be placed loose in the strainer chamber. It can easily be inserted in practically any type and make of fuel unit.

More information? Enter Item 26 on postcard, page 126

Residential Cooling Tower

An extra quiet cooling tower, for use with built-in residential air conditioning installations, is announced by Binks Mfg. Co., Chicago, Ill. Designated as Model B-23, it was designed to meet the fast-increasing demand for a suitable, silent unit of adequate capacity for use with central air-conditioning equipment in private homes. It is described as small, compact and noiseless in operation. It can be installed in the basement, utility room, garage or outdoors.



The tower conserves the cooling water required for the condenser of all water-cooled refrigerating units and is said to save more than 95% of the water normally discharged to waste.

The tower is a self-contained unit, ready for home installation. The fool-proof circulating pump and the efficient low-speed blower are driven by a single motor. Operating costs are only a few cents a day.

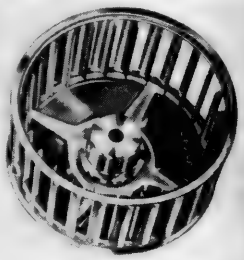
The controlled air movement through the tower is independent of natural breezes and moves up in the opposite direction to the downward water flow. This accelerates the cooling rate. The motor is cradled in rubber. High-efficiency nozzles are used to give full water break-up. Inside surfaces of the galvanized casing and blower are heavily coated with automotive underbody coating. To prevent corrosion, and insure long life, these towers are factory-sprayed with two coats of aluminum paint. The unit is completely factory assembled.

The towers are available in A, B and C models, equipped respectively with ¼, ½ and ¾ hp motors.

More information? Enter Item 27 on postcard, page 126

New Burner Blower Wheels

Development of two new sizes of blower wheels especially designed for oil burner application is announced by The Torrington Mfg. Co., Torrington, Conn. The wheels are being produced in 5⅛- and 5¾-inch diameters.



The two new sizes add flexibility of choice in meeting accurate design requirements for uniformly balanced air impellers among members of the heating, ventilating and cooling industries. The additional sizes have been found necessary because of requirements to obtain additional air within the physical size limitations of existing equipment.

The new 5⅛-inch AIRotor, designated Series 504, is available in widths of 1⅛, 2-1/16, 2-15/32, 2⅞, 3⅛ and 3½ inches.

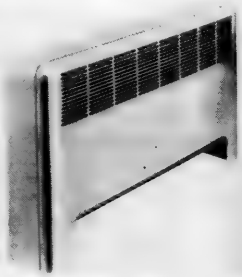
The 5¾-inch Series 524, is manufactured in widths of 1-5/32, 2-1/16, 2½, 2-29/32, 3⅛, 3½, 3-25/32 and 4¼ inches.

More information? Enter Item 28 on postcard, page 126

Convector-Radiator Line

A new line of convector radiators has been added to the Herman Nelson heating and ventilating products, it is announced by American Air Filter Co., Louisville, Ky.

The convectors are designed especially for economical, responsive heating operation. The lightweight heating elements are seamless copper tubes, mechanically expanded into aluminum fins. Tubes are permanently joined to copper headers with a high temperature solder, for maximum heat transfer efficiency.



The convector-radiators are available with tappings for two-pipe steam, two-pipe hot water and one-pipe steam heating systems.

Cabinets, of heavy gage steel with rounded corners, are designed for both free-standing and semi-recessed installation. The reinforced front cabinet panels are removable, and damper fronts are available. The units are offered in four depths—4, 6, 8 and 10 inches, eleven lengths ranging from 16 to 64 inches, and three heights, 20, 24 and 32 inches.

The convector-radiators have steam capacities rated from 6.6 to 99.4 sq ft of steam rad.

More information? Enter Item 29 on postcard, page 126

Diffuser for Flush Mounting

A new, attractively styled, flush mounting type air diffuser is announced by W. R. Carnes Co., Verona, Wis. It is available in neck sizes from 5 through 20 inches to handle requirements from 80 to 4500 cfm.

This Model E-1 diffuser is styled along the same general lines as Models E, EJ and ER, and was designed primarily for flush mounting on exposed duct work, but can also be used effectively on ceilings. All sizes are equipped with a sponge rubber gasket around the outer edge to form an air-tight seal to assure a leakproof installation.

Installation of this diffuser is simple and inexpensive. The inner vane assembly is removable, which makes attaching the outer ring to the duct if used on exposed duct work, or to a stub duct if used on a ceiling, a quick and easy operation. Then replacing the inner vane assembly with several screws completes the installation.

Accessories include opposed bladed dampers, splitter dampers, equalizing deflectors, radial deflectors and butterfly dampers as well as the Model BF damper, designed for use when the diffuser is installed on exposed duct work.

More information? Enter Item 30 on postcard, page 126

Probe Locates Trouble Source

The Electronic Sound Probe, an instrument which changes vibrations into electrical energy, multiplies the sound volume and transmits it directly into the earphone, is introduced by The Gel-Me Co., Bloomington, Ill.

This compact electronic tool enables users to correctly diagnose and locate trouble spots in any mechanically operating piece of equipment, whether it be a tractor or watch. Through natural reproduction of noise at the source with no distortion, the operator is able to identify and locate the mechanical trouble, thereby saving time and money by avoiding serious and costly shutdowns.

The amplifier unit is contained in a black wrinkle finish metal box. Plug-in type earphones are used in connection with the amplifier for listening to the noises.

More Information? Enter Item 31 on postcard, page 126

Pipe Insulation Sizes Upped

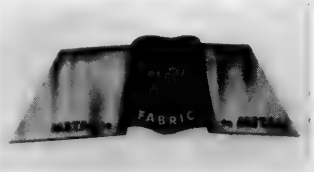
Hot and cold piping from ¾ to 24 inches in diameter can now be covered quickly and economically with Snap-On pipe insulation made by Gustin-Bacon Mfg. Co., Kansas City, Mo., which has expanded greatly the available sizes of this insulation. It is now available in three and six foot lengths, depending on pipe size. Small pipe sizes (diameter ¾ to 2 inches) are in three-foot lengths. Wall thicknesses of ½, ¾, 1, 1½ inches are available in sizes to 12 inch pipe size; and 1, 1½, and 3 inch wall thickness for piping above 12 inches diameter up to 24 inches.

Several properties are claimed for the insulation. molded of glass fibers. It will not break in shipment or on the job, and is virtually immune to damage from wetting or bumping. It is feather light and literally a one-man application.

More information? Enter Item 32 on postcard, page 126

One-Piece Duct Connector

Pre-assembled Duro-Metal-Fab, which permits simplified fabrication of flexible duct connections at savings of up to 70% in shop time, is announced by Duro-Dyne Corp., New Hyde Park, N. Y. It is a one-piece metal-to-fabric-to-metal duct section assembled and ready to use, consisting of a 3-inch strip of U.L.-approved canvas, asbestos or Neoprened Fiberglas (water, fire and mildew-resistant) double locked to 24 gage galvanized metal edges.



These edges are wide—3 and 4 inches—permitting fast, strong joints of all types: clinch-collar, round flange, flange, slip, crimp, bead, or square to round, etc. The metal-to-fabric Double-Loc seam eliminates separation of fabric from metal.

The product comes in 100-foot coils in a handy dispenser carton which is placed beside the work table; the product is then pulled out flat, ready for measuring and cutting.

More information? Enter Item 33 on postcard, page 126

Tool for Joining Soil Pipe

A tool for joining two lengths of soil pipe with speed and ease is the Soil-Piper, introduced by Dreier Brothers Inc., Chicago, Ill. With this tool two lengths of soil pipe are inserted on the wheels, the spigot of one inserted into the hub of the other so that both lengths are held perfectly in line, and turned together on ball bearing rollers as they are yarned and caulked. This allows the workman to work on top of the hub all the time.

By joining two lengths at a time, it is easier to lay the pipe in the ground and time is saved in digging bell holes and making joints in the ditch. The tool is made of aluminum alloy with steel parts cadmium plated. It is packed in a set of three brackets with rollers and bolts ready assembled.

More information? Enter Item 34 on postcard, page 126

Industrial Radiant Heater

After a three-year period of field testing, a new type radiant heater is being marketed by Union Chill Mat Co., Pittsburgh, Pa.

The new heater, called Down-Beam, employing the principal of infra-red or radiant heating, is designed for overhead installation and makes localized comfort practical and economical in large, unheated mill and factory buildings. Installed over a production bench, it keeps worker, tools and work at a comfortable temperature, even though surrounding air temperatures are far below the comfort range. It saves floor space occupied by salamander-type heaters.

The heater is of extremely simple design, involving only a small gas burner playing into a suspended bed of alloy steel wool. The metal wool remains incandescent from the instant the gas is ignited until turned off. The high temperature incandescence, under excess air conditions, prevents the escape of incomplete combustion products. The top baffle plate of the heater housing remains cool and can be safely installed without outside venting, close to wood framing.

Photo shows unit after three winters' operation.

More information? Enter Item 35 on postcard, page 126

New Shaded-Pole Motor

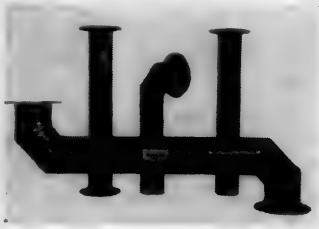
Greater mounting versatility and increased shaft rigidity are features of an improved shaded-pole fractional-horsepower motor announced by General Electric Co., Specialty Component Motor Dept., Schenectady, N. Y.

The KSP 21-frame motor is designed for use on room air conditioners, unit heaters and coolers, exhaust and circulating fans, furnace blowers, evaporative coolers, and window fans. It is suited for application to mechanical drives with moderate radial and axial thrust where quiet performance is required.

More information? Enter Item 36 on postcard, page 126

Corrosion-Resistant Ducting

A line of fiber glass mat-impregnated and bonded ducting, vent pipe and fittings is being made by Du Verre, Inc., Hamburg, N. Y. Made of polyester resins to form a homogeneous unit that has great corrosive resisting properties due to the elimination of porosity, the ducting has chemical resistance approaching glass, yet its strength is equivalent to steel on a unit weight basis.



The ducting, pipe and fittings are fabricated with precision which results in ease of installation and low cost. Complete custom built installations can be fabricated from drawings or sketches of existing sheet metal systems or engineering assistance is available to franchised representatives.

The manufacturer points out that their firm is seeking sheet metal contractors and heating contractors who have customers in the chemical and food processing line. Any such firm wishing will be granted exclusive sales rights in their territories.

More information? Enter Item 37 on postcard, page 126

Forced Air Convector

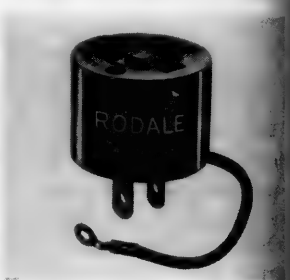
The Model H-C-13 He-Co-Vectair forced air convector for heating and cooling is introduced by Auburn Burner Co., Auburn, Ind. The units are sized to fit between standard studs with no carpentry required. The contractor simply sets in place and fastens to studding. There are only two sweat joints per unit. They are designed to be used with forced hot water during the winter and with cold water circulating systems in the summer.

Installations can be made in parallel with reverse return loop. Each unit is operated independently and can be individually controlled. The unit has a capacity of 13,000 Btu per hr for heating and 5,000 Btu per hr for cooling.

More information? Enter Item 38 on postcard, page 126

Conditioner Grounding Adapter

A newly-designed 3-wire U-blade grounding type adapter designed for use with all types of home air conditioners in grounding exposed metal parts, has been added to the line of the Rodale Mfg. Co., Inc., Emmaus, Pa.



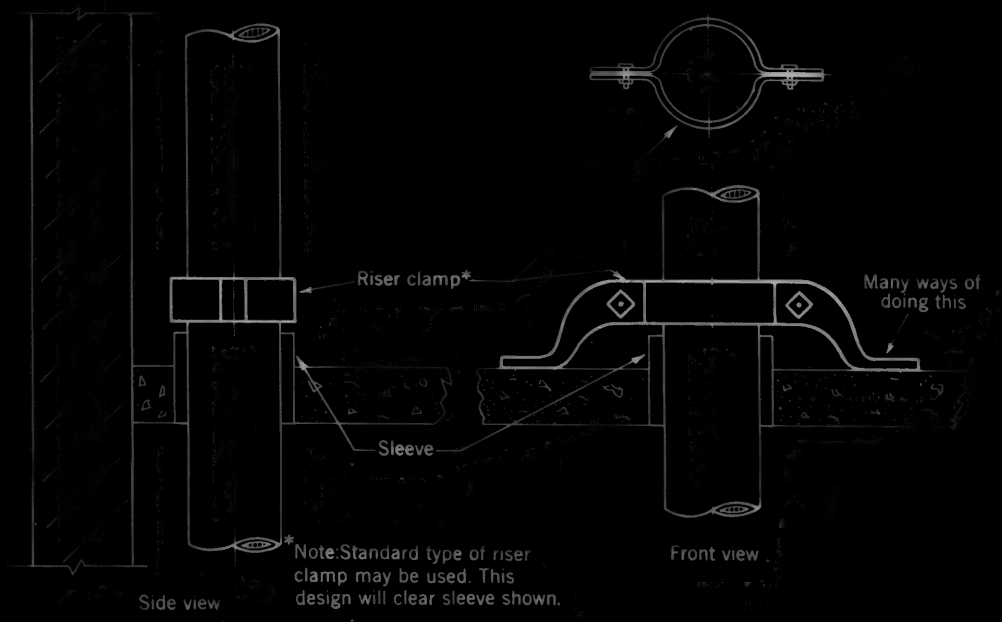
Listed as No. 578L, this device will adapt a wiring system with a 3-wire U-blade cap to the normal parallel blade receptacles. It features a sturdy heavy-duty bakelite composition construction, bronze contacts, a green hexagonal grounding screw, parallel polarized brass blades, and a 3-inch grounding lead with circular terminal for quick connections. It is also available without the lead as No. 578.

Use of this new adapter affords a method of quick adaptation of 3-wire systems to all standard convenience outlets utilizing a 3-wire system. It is rated 15 amperes, 125 volts.

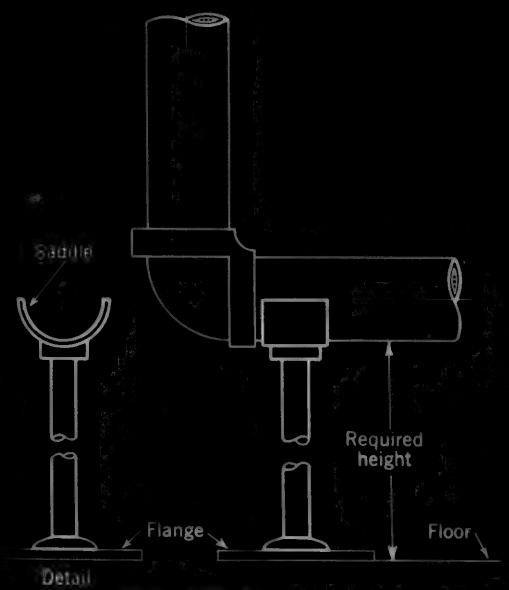
More information? Enter Item 39 on postcard, page 126

(*Continued on page* 112)

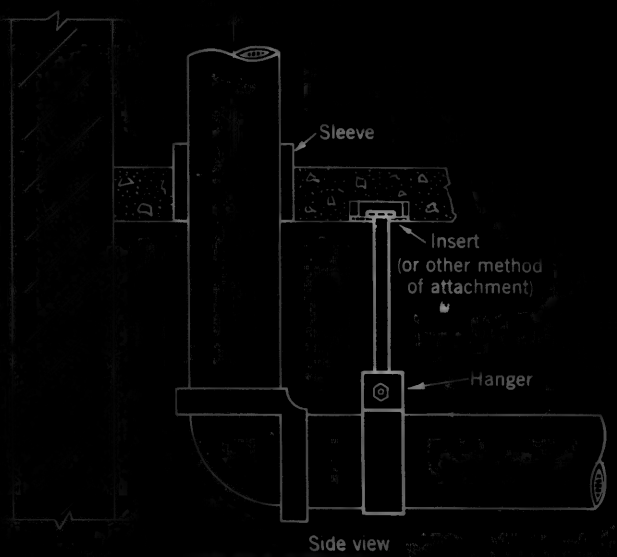
STANDPIPE RISER SUPPORTS


Riser clamp*
Many ways of doing this
Sleeve
*Note: Standard type of riser clamp may be used. This design will clear sleeve shown.
Side view
Front view

CLAMP SUPPORT



BASE SUPPORT



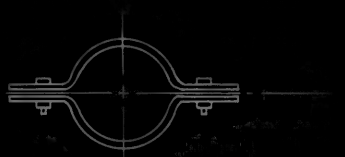
HANGER SUPPORT

Note: Where risers are supported at the ground and are without offsets, support about every 4th floor. Where they do not have support from the ground, support at every floor. If riser is more than ten stories, supports are required at the ground level, 5th, 9th and every 4th story above. In heavily constructed buildings ten stories in height, no support is required above the 5th floor. In buildings of light construction, additional supports are required. Riser clamps should not be of the set screw type.

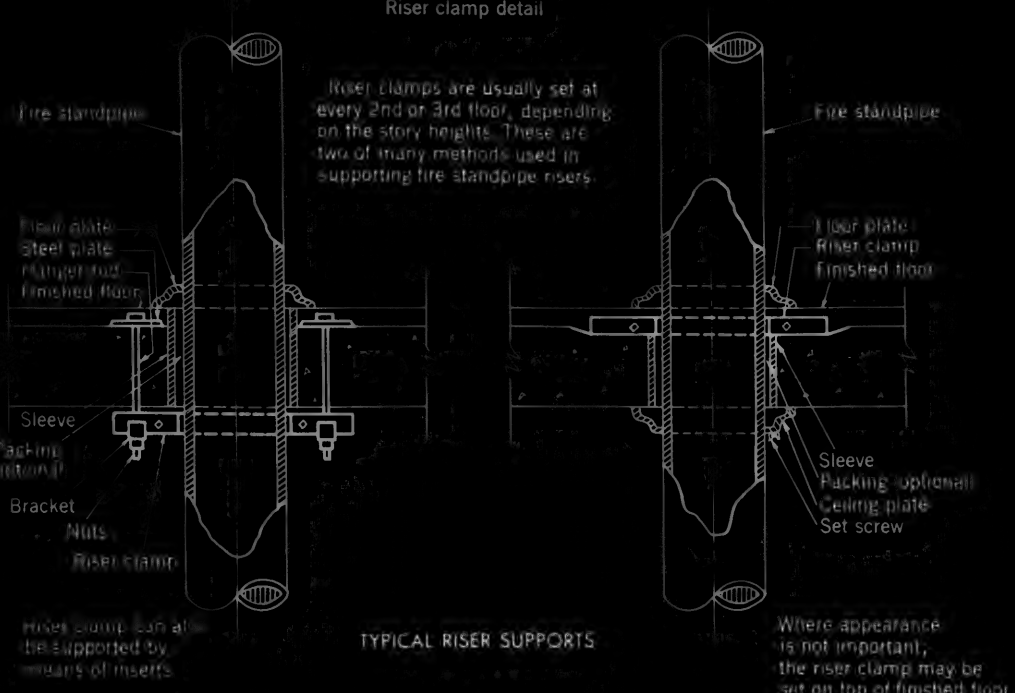
DETAILS THROUGH THE COOPERATION OF
HAROLD HERKIMER, NEW YORK, N.Y.

HEATING AND VENTILATING'S DETAIL SHEET

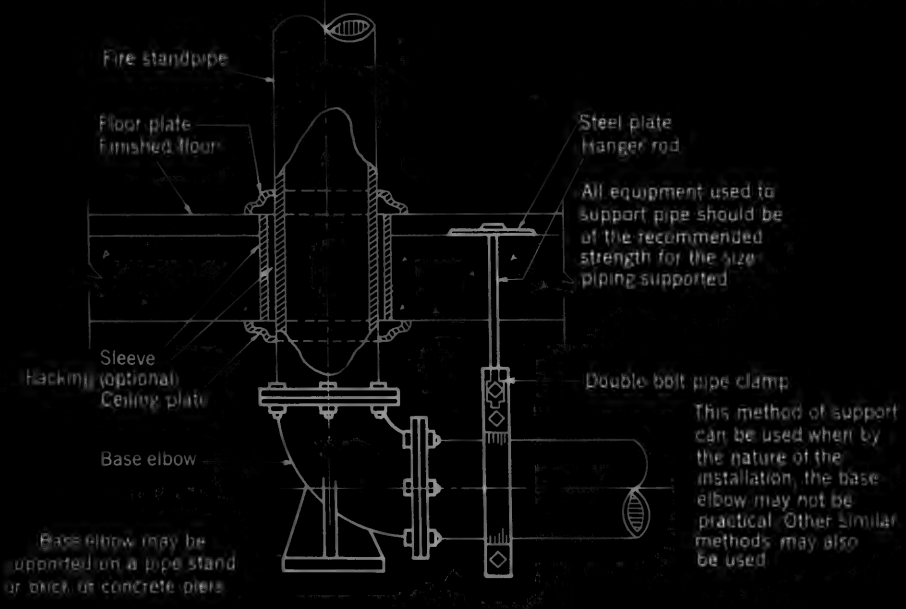
STANDPIPE RISER SUPPORTS



PLAN
Riser clamp detail


Riser clamps are usually set at every 2nd or 3rd floor, depending on the story heights. These are two of many methods used in supporting fire standpipe risers.
Fire standpipe
Floor plate
Steel plate
Hanger rod
Finished floor
Sleeve
Packing (optional)
Bracket
Nuts
Riser clamp
Riser clamp can also be supported by means of inserts
Fire standpipe
Floor plate
Riser clamp
Finished floor
Sleeve
Packing (optional)
Ceiling plate
Set screw
Where appearance is not important, the riser clamp may be set on top of finished floor

TYPICAL RISER SUPPORTS


Fire standpipe
Floor plate
Finished floor
Steel plate
Hanger rod
All equipment used to support pipe should be of the recommended strength for the size piping supported
Sleeve
Packing (optional)
Ceiling plate
Double bolt pipe clamp
This method of support can be used when by the nature of the installation, the base elbow may not be practical. Other similar methods may also be used
Base elbow
Base elbow may be supported on a pipe stand or brick or concrete piers

TYPICAL BASE SUPPORTS

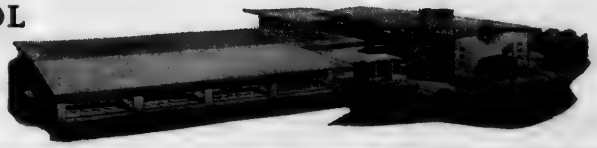
DETAILS THROUGH THE COOPERATION OF
LOUIS BLENDERMANN, ENGINEER, GLEN COVE, N.Y.

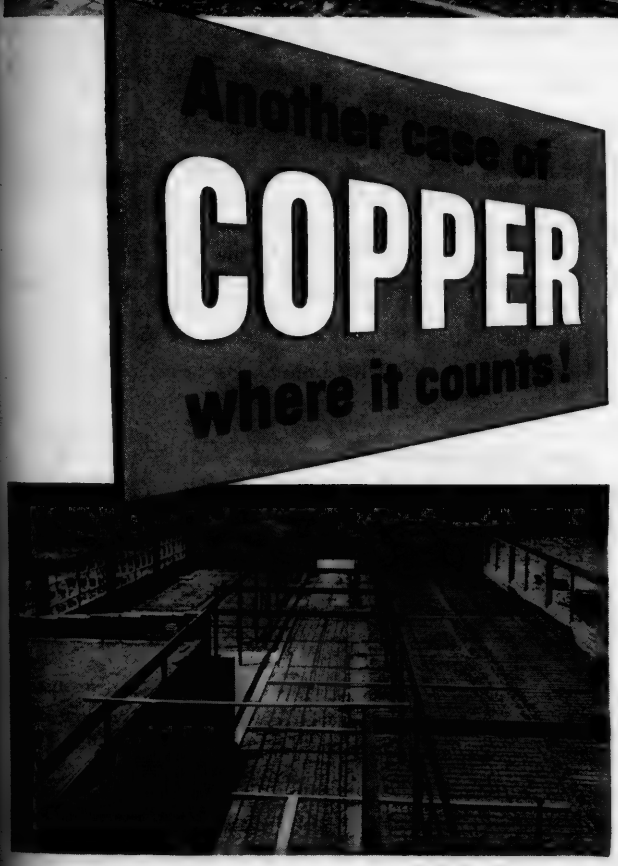
HEATING AND VENTILATING'S DETAIL SHEET

MANCHESTER ELEMENTARY SCHOOL

Manchester, Missouri

Architect: CHARLES W. LORENZ, Kirkwood, Mo.
Contractor: JUENGEL CONST. CO., St. Louis, Mo.
Radiant Heating: BAGLEY & COMPANY, Inc., Robertson, Mo.
Revere Distributor: GRINNELL COMPANY, Inc., St. Louis, Mo.





TWO VIEWS of the radiant Panel heating layout before concrete slab was poured. Floor area over 17,000 sq. ft. System was imbedded in slab 4". Gravel fill is 6" deep. Coils are 12" OC. System is divided into 4 zones, with all supply and return lines also of copper. Note edge insulation at right in large photo.

Radiant Panel Heating fits perfectly into the growing trend to 1-story school construction. It means warm floors, no drafts, and a healthier atmosphere for scholars. To the architect radiant panel heating means greater latitude in design, more usable space for the money. And for the user it means greater heating efficiency, lower redecorating costs and less cleaning and maintenance than when old-fashioned heating methods are used. The ideal material for panel heating is copper. For no other metal or alloy has all the desirable construction characteristics of this "ageless" metal.

To the contractor, the use of Revere Copper Water Tube means easy bending and handling . . . its long 60' lengths require fewer fittings, the solder fittings used eliminate the need for welding, wrench work and thread cutting, while its lasting, non-rusting qualities have been proven through the centuries. Even being buried in a concrete slab doesn't bother enduring copper. Copper is the metal you can trust.

Keep out of trouble, protect your reputation for quality work . . . use Revere Copper Water Tube for air conditioning lines, radiant panel heating, hot and cold water lines, underground service lines, waste stack and vent lines, processing lines. See the Revere Distributor nearest you today. And, if you have a technical problem, he will put you in touch with Revere's Technical Advisory Service.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

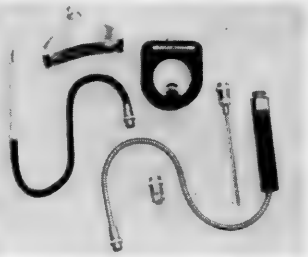
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

(*Continued from page* 108)

Pyrometer Fits Pocket

The Model 240-T pocket pyrometer, measuring only 3⅞ x 3½ x 1¾ inches and with a 2.4-inch direct reading indicator scale, is introduced by Cybertronic Corp. of America, Chester, Pa. It offers quick, accurate measurement of surface and sub-surface temperatures through the use of interchangeable thermocouples. It is housed in a shock-absorbing rubber case which protects the instrument against normal shock. It is available in six standard ranges starting at 400 deg F. This model is shown in photo.

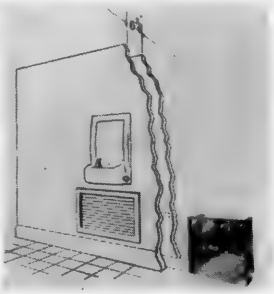


The company also is introducing the Model 505 electronic instrument to control high temperature furnaces and other heating applications. Using a thermocouple type pyrometer in the input circuit of the electronic instrument and a power relay in the output circuit, the device may be used not only for controlling temperatures, but it also indicates and limits temperatures. It has thermocouple break protection and is fail safe.

More information? Enter Item 40 on postcard, page 126

Drinking Fountain Cooler

A new Wal-Pak cooling unit for drinking fountains, only 6¾ inches deep for use in schools, office buildings, industrial plants, hotels, variety and department stores, theatres, hospitals and institutions, is announced by Filtrine Mfg. Co., Brooklyn, N. Y.



The unusual compactness of this unit permits in-the-wall mounting under any new or existing fountain. Although small in size, the unit has the same rugged construction of the company's other water coolers. It also features large storage reserve which assures cooled drinking water at all times, even during periods of peak demand.

Another important advantage of the unit is that its in-the-wall mounting leaves corridors unobstructed, with no projections to mar their beauty.

More information? Enter Item 41 on postcard, page 126

Pipeline Shock Absorber

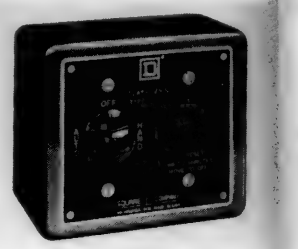
A new shock absorber which promises to end the annoying problem of water hammer in pipe lines is announced by Josam Mfg. Co., Michigan City, Ind. Water hammer accurs in pipe lines even when its presence is not indicated by noise. Breakdowns of coils in heaters, power equipment, washing machines, pumps and similar equipment are all evidence of destructive vibration caused by water hammer. This shock absorber has a specially milled Flex-lastic insert and a compression molded tube in the steel shell so that the thrust and impact of the water entering the tube expands it against the insert until the energy caused by the pressure is dissipated. As the shock recedes, the tube and insert regain their original form, ready to receive the next shock impulse.

The tube and insert never reach their elastic limit regardless of the shock to which it is subjected. Under accelerated and fatigue tests equal to several lifetimes of use these new shock absorbers have withsttod maximum distortion, maximum aging and tensile strength, whereas, in the relief devices now in use, the expansion to dissipate the shock must operate within the physical limits of the metal or fabricated joint without distortion beyond the possible recoil to its original shape.

More information? Enter Item 42 on postcard, page 126

Motor Selector Switch

The expanding air conditioning and heating market has created a substantial demand for selector switches and fractional horsepower manual starters. To meet this requirement, the Square D Co., Milwaukee, Wis., has introduced a selector switch and fractional horsepower manual starter in a single, compact, diecast enclosure.



Installation costs are reduced because there is only a single device to be mounted and wired. The Auto-Off-Hand selector switch permits remote control from a thermostat, or local control from the starter. The manual starter provides motor overload protection.

Two manual starters, without the selector switch, are also available in the same enclosure. Maximum ratings are 1 hp at 115 or 230 volts single phase AC, or 115 or 230 volts DC.

More information? Enter Item 43 on poscatrd, page 126

Temperature Control Valve

A new temperature control valve is announced by Klipfel Valves, Inc., Hamilton, Ohio. The new valve, designated as No. 1549, is pilot operated for sensitive, yet dependable service and is a tight closing type valve. Particularly in the larger sizes, the valve is designed for high pressure service. The 5 and 6-inch sizes are double seated, while smaller valves are single seated.

Construction and operation are simple. The pilot valve is actuated by hydraulic expansion of the thermo-sensitive charge in a one piece metal bellows. The pilot valve employs the inlet pressure to control the main valve, admitting the inlet pressure to the diaphragm chamber to open the main valve when temperature is low and allowing it to bleed off when temperature is high.

The valve is manufactured in sizes from ¾ to 6 inches.

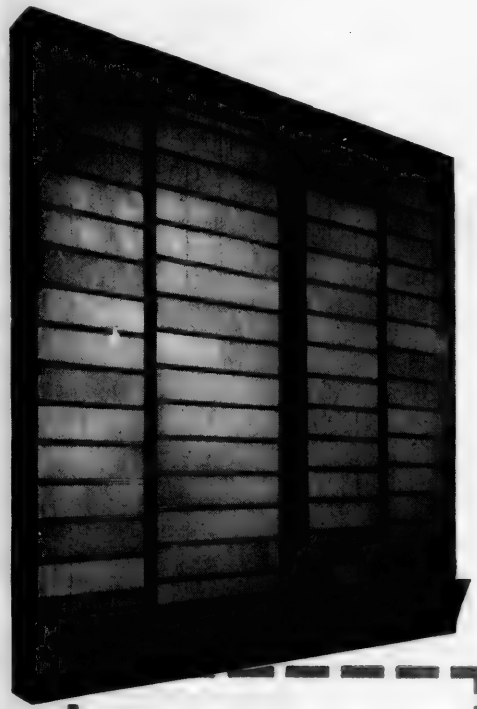
More information? Enter Item 44 on postcard, page 126

(*Concluded on page* 114)

38,977,573 CFM

FILTERED BY CONTINENTAL SELF-CLEANING AUTOMATICS

RIGHT THIS MINUTE!



In six results-proving years, Continental has furnished its advanced-design, self-cleaning automatic air filters for both large and small installations on four continents. In that time others in the air-filtration industry have conceded the superiority of Continental by redesigning their equipment to approximate some of the outstanding advantages of Continental's advanced engineering.

For your air-cleaning needs, check Continental immediately.

WRITE TODAY

If you are not already acquainted with Continental's local representative in your area —write directly to the home office.

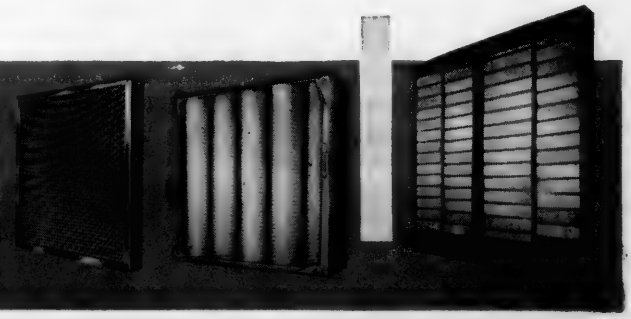
Please send:

Automatic Filters Bulletin 201-D ☐

Installation list of Continental Automatics ☐

P.O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.



(*Concluded from page* 112)

Flexible Air Conditioners

A line of self-contained central air conditioners of a flexible design whereby they may be used for residential or commercial applications, is being marketed by U. S. Machine Div., Stewart-Warner Corp., Lebanon, Ind. The line includes a 2 hp air cooled and 2 and 3 hp water cooled unit.

Shown is a standard 3 hp air cooled residential unit, converted into a commercial cooler with but two additions. A hood was placed on top to deflect air, and an adaptor was set over the filter for return air. By adding side registers, air may be moved in two or three directions. Installation requires two openings in the wall, one for bringing in air and the other for the exhaust. These free standing units are flexible enough for most commercial needs.

Stripped of the hood and adaptor, the standard home cooling conditioner can be used in conjunction with the present furnace, or by itself in basement, utility room or attic. Built in two sections, it may be stacked as pictured, or where head room is limited the top section is based on the floor behind the condenser blower and motor.

The compressor is hermetically sealed at the factory and never needs oiling. The filter area is over 440 square inches. Cabinet is durable baked-on enamel, made of heavy gage steel for long life.

More information? Enter Item 45 on postcard page 126

Electric Steam Generator

A compact, new electric steam generator, capable of building 100 lb of live steam pressure at 320 deg F in five minutes and featuring only two moving parts, is distributed by Dryomatic Corp., Alexandria, Va.

The Electro-Steam generator provides a source of steam for retail clothing stores, hotel valet shops, commercial laundries and dry cleaning plants, laboratories, and health clubs. It is suited for use as a steam cleaner in garages, service stations and in the building maintenance and construction industries. It features fully automatic safety controls and bears complete UL and ASME approval.

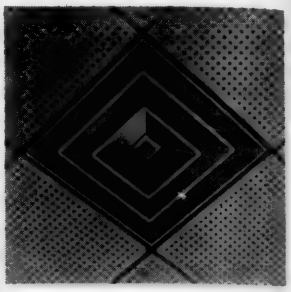
The generator eliminates the need of flue, fuel tank and fuel line. Installation requires only a 220-v outlet and water connection. Simple valve adjustment delivers live steam, hot water, steam and detergent solution or cold-water rinse, as needed. Nearly 100 percent of heat input is achieved with three completely immersed heating units.

The unit, which is enclosed by an all-steel cabinet, weighs 275 lb and measures 34 inches long by 15¼ inches wide by 36 inches high. It has a ½-inch outlet for steam and ⅜-inch connection for water. Accessories available for steam cleaning include detergent tank, steam and detergent hoses, and steam nozzle gun with insulated handle. Installation of the 2¼ hp, 3½ hp, and 5 hp unit can be either portable or permanent.

More information? Enter Item 46 on postcard, page 126

Adjustable Square Diffusers

A new line of adjustable square air diffusers with built-in equalizing deflectors and rectangular air diffusers for 2, 3, or 4 way diffusion is announced by Universal Diffuser Corp., New York, N. Y. The Type H Flexiflo square series is manufactured in styles for plaster or acoustical tile ceiling installations. The easily adjustable vanes increase or decrease volume as desired without auxiliary dampers and can be locked into place. Adjustment of the diffuser only changes the volume; pattern of diffusion remains constant. This feature makes balancing an air distribution system a simple matter and facilitates air volume changes on the job.



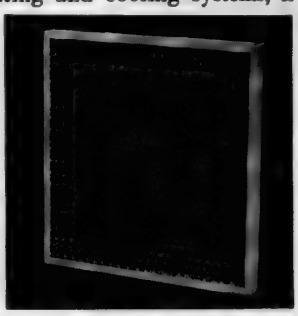
Six sizes are available from 4 to 16 inches neck diameter.

The Type MP Multi-Pattern rectangular series uses the same blade form as the square model, with no blank-off, and is designed for use in areas of irregular shape. All sizes and designs are available including long strip units up to 72 inches in length.

More information? Enter Item 47 on postcard, page 126

All-Aluminum Air Filter

An all-aluminum lifetime air filter for commercial, industrial and residential heating and cooling systems, is introduced by The George Evans Corp., Moline, Ill.



This new filter is precision made and this accomplishes what the company calls precision air cleaning. For example, these filters are so made that in a 20 x 20 x 2-inch size filter there are 76,060 precision made openings.

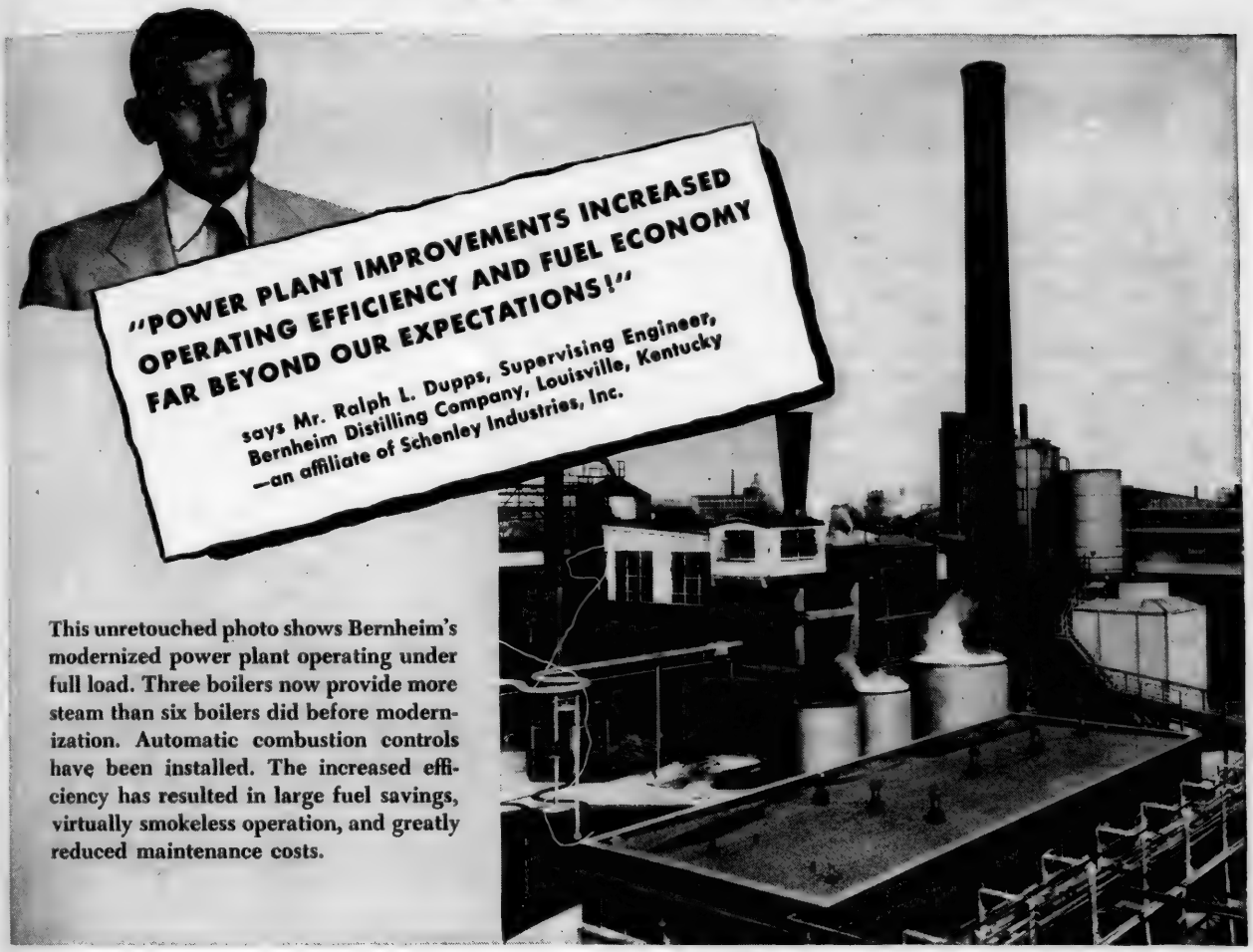
The precision angled openings set up a higher turbulence within the filter and cause the air to travel over 3.5 times the width of the filter from the inlet to the outlet side. The filter pack is exactingly machine stamped to have rough, talonlike burred edges which grip and hold the dirt.

The filter pack is made with larger openings on the inlet side and progressively smaller openings on the outlet side. This makes it possible to hold the lint at the same time the progressively smaller openings permit dirt to penetrate deep into the pack instead of matting on the intake face.

The filters are all aluminum and in areas where there is corrosive action in the air, the filters may be anodized to give them great protection against any corrosion activity.

More information? Enter Item 48 on postcard, page 126

"WE CUT OPERATING COSTS $67,000 A YEAR— BY BURNING COAL THE MODERN WAY!"


"POWER PLANT IMPROVEMENTS INCREASED OPERATING EFFICIENCY AND FUEL ECONOMY FAR BEYOND OUR EXPECTATIONS!"
says Mr. Ralph L. Dupps, Supervising Engineer, Bernheim Distilling Company, Louisville, Kentucky —an affiliate of Schenley Industries, Inc.

This unretouched photo shows Bernheim's modernized power plant operating under full load. Three boilers now provide more steam than six boilers did before modernization. Automatic combustion controls have been installed. The increased efficiency has resulted in large fuel savings, virtually smokeless operation, and greatly reduced maintenance costs.

Why not take *full* advantage of coal's economy? Cut your operating costs to a minimum with automatic coal- and ash-handling equipment. Get more steam for every dollar with an up-to-date combustion installation.

Whether you're building a new plant, or planning to modernize, a consulting engineer can show you how you can get big savings by burning coal in a modern plant designed to meet your *specific* needs.

Consider, too, that of all fuels, coal alone has virtually unlimited reserves. And America's coal industry leads the world in efficient, economical production. That means that, unlike other fuels, ample coal will be available in the future—and at relatively more stable prices.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

LONDON LETTER

Commentary on developments in Europe by our correspondent in Great Britain

SUMMER in England, which sometimes falls on Tuesday in August, threatened this year to occur at the beginning of May. This un-English behaviour was neatly scotched by the arrival in the Thames of the Duke of Edinburgh and his wife, who brought with her some more of that weather which we now recognize as appropriate for State occasions, and which has made her subjects on the arid African plains convinced she is descended from the beneficient goddess of rain. However, the set-back was only temporary, and a few weeks later the sunshine was so tempting that your Correspondent decided to write this *Letter* in the garden. In a comfortable chair the hum of the bees on the raspberries blending with the holiday traffic on the Brighton Road, it was really very peaceful and pleasant. . . .

The Mersey Tunnel

Leaving Queenie, the pony, in charge of the gardener we left the old home near Manchester and sped out along the West Lancashire Highway to Liverpool, on the first stage of a tour to inspect the ventilation of Europe's tunnels. The tunnel under the Mersey is one of the largest in the world, 3,800 yards between the principal entrances and 170 ft below high water mark at its lowest point. There are 6 ventilating stations, 3 on each side of the river, equipped with 30 fans with rotors 7 ft 6 in to 28 ft dia. The total installed horsepower is 5,140, but even at maximum output only half this is in use, because the fans are in pairs, only one of which can be used at a time. Rather more than half the fans are exhausting, the tunnel entrances being used as air inlets. The system may be described as semi-transverse, because the major part of the ventilating air goes from the ventilating stations along ducts below the sidewalks and enters the main roadway through slots. In a truly tranverse system it would be sucked out again through slots into another duct, but in this case it travels longitudinally towards the nearest ventilating station where it is removed through a hole in the roof. We were told that there must be sufficient air change to keep the carbon monoxide down to a level safe for the men working in the tunnel, but that excessive ventilation is also to be avoided. On foggy days the warmth of the traffic can make the atmosphere in the tunnel clear if the ventilation is just right. So the control room at George's Dock is supplied with CO recorders, fog indicators, and information about temperature and fan output, and any fan can be operated over a wide range of output. Two windings give three speeds, and hydraulic couplings can be used as reduction gears.

From Birkenhead on the south bank of the Mersey to the quaint old town of Chester, the old Roman camp at the end of Watling Street, which is just beginning to wake up to the fact that it is the center of an area of modern chemical industry. Then down Watling Street itself, in its modern guise of Main Road A5, one of the straightest in Britain except for an awkward detour by Kilsby Railroad tunnel, its course shown by the circular red brick ventilating shafts surmounting the hill. The ventilation of railroad tunnels is comparatively simple. Reliance is placed on the trains pushing a lot of air through with them, and the only difficulties that have been met with occur when there is a following wind in single track tunnels. In some cases in the days of steam trains in the Alps the oxygen content of the air around the engine fell low enough to put the lamps out (around 17 percent O_2). One or two accidents occurred through the engineer being temporarily asphixiated too, and not coming around in time to obey signals at the exit. There was also that dreadful accident in Italy some years ago when a train stopped in a tunnel and hundreds of passengers were suffocated. Not many months ago a train came through Kilsby with the front bogie of the engine off the rails, but this notoriety did not seem a good enough reason for leaving Watling Street for 5 miles. The old road is still there, straight and true, and as we rejoined the route we looked back and saw a truck keeping to the 2000-year old lane; there was no room for anything to pass him.

Thames, Scheldt and Maas Tunnels

Watling Street becomes lost soon after St. Albans (the Roman Verulam) but there is a short street just by St. Paul's Cathedral that bears the name. We went along it and crossed under the Thames by the Blackwall Tunnel, built in 1897 for nothing more obnoxious than horse traffic. That journey was a nightmare. The roadway is only 16 ft wide and as we squoze past a bus grinding its tyre against the kerb we noticed all the passengers were sitting on the far side. This is a wise precaution because every so often a vehicle that's just too wide will smash every window of a bus as it passes.

The first tunnel under the Thames was built by Brunel in 1825-42. Previous to this there had been no tunnels constructed for several centuries. The Thames Tunnel is now used by the Metropolitan Railway, and there are four burrowings under the Thames by the Tube. The ventilation of the London Tube is itself of some interest. At first they thought they could manage without, since they did not run steam trains like the Metropolitan. Then the Central line installed a fan at one end of its 5 miles of line and used it to purge the system at night. The next development was the installation of small fans at most stations blowing in ozonised air, thus making it unneces-

(*Continued on page* 118)

The first product of Taylor Forge is still first in the light-wall pipe field. Its spiral welded seam makes it stronger in every way than any other pipe of its weight.

Sizes, 6" through 36". Thicknesses 14 gage through ¼".
All types of end joints, fittings and fabricated assemblies.

See your Taylor Forge Distributor for up-to-the-minute facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • General Offices and Works:
P.O. Box 485, Chicago 90, Illinois • Offices in all principal cities
Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ontario, Canada

Taken in 1905...

This faded photo was snapped five years after Taylor Forge started back in 1900. That line-up of old timers were putting on a convincing demonstration of the first Taylor Forge product—"Taylor's Spiral Riveted Pipe."

The clothing and hat styles may be dated, but not the pipe. Taylor Spiral Pipe (now welded instead of riveted) then was, and still is, the strongest pipe of its weight.

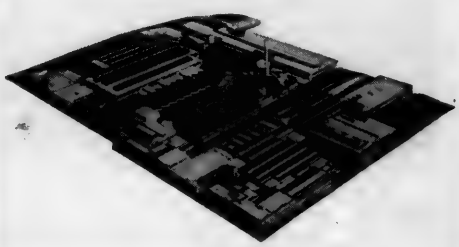
But while the pipe itself proved revolutionary, the only flanges then available for it—cast iron flanges—were not up to the standard of the pipe. The iron flanges often cracked and caused trouble...and since Taylor Forge couldn't *get* better Flanges, Taylor Forge decided to *make* better flanges.

So in that long-ago Taylor Forge set up facilities for making forged steel flanges. It was a pioneering step ...the first time forged steel flanges had been made on a commercial scale. It was also a turning point...for it marked the transition from simply making pipe into the field of *designed* piping.

An episode in the story of Taylor Forge leadership in designed piping

We started here in 1900.

One of the five Taylor Forge plants of today is shown below.



(*Continued from page* 116)

sary for Londoners to go to the seaside for their ozone. Now, however, most of the fans are of the extraction type, the passenger entrances at the stations serving to bring in fresh air, so that there is no sensation of stuffiness on entering.

The main problem now is the slow accumulation of heat, which in some sections of the line is generated faster than it can be removed. More air at the stations would create unpleasant gales, already fierce enough in some places when the trains move. So some relief shafts and fans have been installed between stations. We went to see the fan building in Kennington Park not far from the Oval Cricket Ground, and found a pleasantly-designed park shelter with nothing to indicate its true purpose.

Somehow we reached the Hook of Holland and motored to Rotterdam. The tunnel under the Maas has clover-leaf connections to the main roads and little faith in the reliability of automobiles. Below ground there are garages to deal quickly with breakdowns. At each end of the underriver section, 625 yards long, there are ventilating shafts and lifts for foot passengers and bicycles. A few miles South there is Antwerp and the Scheldt, where pedestrians and cyclists have a tunnel all to themselves. The vehicle tunnel has a roadway 21 ft wide with a height of 14 ft and is pleasantly lit.

Mont Blanc and Tunnels in Italy

The Romans made several tunnels in Switzerland, though even these are not the world's oldest. There was a tunnel at Jerusalem before the Israelites arrived, and there was a tunnel under the Euphrates at Babylon. Before the Roman Empire there were the tunnels through the mountains near Naples. One of these is nearly 1,500 yards long, 30 ft wide, and 30 to 80 ft high, and we were keen to see it. Through Geneva then to Chamonix where the project of a tunnel under Mont Blanc to connect France and Italy has been talked of for over a century. The approaches are so favorable that at a height of 4,000 feet the tunnel needs to be some 7½ miles long only. The difficulty with boring through a mountain is the heat, and although the rock structure was well known before starting, there was a little trouble to keep the workers cool. It is useless to pump cold air to the workings, because it gets warm on the way in. It is necessary on a job like this to supply cold water and evaporative cooling at the working face.

London Tube fan building in Kennington Park.

Road tunnel under Porte Clichy, Paris.

The Italians had contended that by arranging the altitude at one end to be 4,100 ft and at the other 4,500 ft a chimney effect would be created. The air would pick up moisture and increase in temperature, and would naturally flow through at about 8.5 ft per second. On the basis that one average motor vehicle requires 18,000 cu ft of air per mile to dilute the CO to under 0.04 percent, this would be enough ventilation for vehicles 4 minutes apart, four or six in the tunnel at a time. French engineers had pointed out that the tunnel would be on the direct route from Paris and Geneva to Turin, and would carry more traffic than this. They proposed truly transverse ventilation, with ducts tapering towards the center, and fans consuming 4,800 horsepower. We were curious to learn the outcome of this controversy. We found that diesel-engined vehicles were allowed straight through but we had to have a small trailer attached which dealt with the CO in our exhaust. With this invention, natural ventilation was good enough, despite as much traffic as the French had feared.

All the tunnels in Italy are ventilated naturally. There are eleven of them in the lovely valley of the Po, and we went through them all. "See Naples and die" is the proverb, but we seemed to be still alive after the visit, and came back along the coast. Genoa is remarkable for being built on different levels. Sloping tunnels for the funicular railways have been in use since 1905. From 1925 onwards a number of road tunnels on the level have been built under the higher parts of the town.

France and The Channel Tunnel

Monte Carlo, Nice, Cannes, Toulon, Marseilles, and northwards through Avignon to Lyons. Here on the edge of the Alps are most of France's tunnels. The majority are ventilated naturally, but that under the Croix-Rousse is supplied with fans that draw in air at the rate of over 1½ million cfm from an intake 70 ft above grade level. At the tunnel under the Mont du Chat, which connects the Lac du Bourget with Lyons, special attention is given to lighting. Human eyes adjust themselves to a wide range of intensity, but this takes time. The transition from daylight to sodium-vapor lamps and back must be gradual, which is why most tunnels have curved entrances and exits. At the Lyons end of this tunnel the same effect is

(*Concluded on page* 142)

BALTIMORE AIRCOIL COMPANY, INC. *Baltimore 18, Maryland*

PRODUCT APPLICATIONS

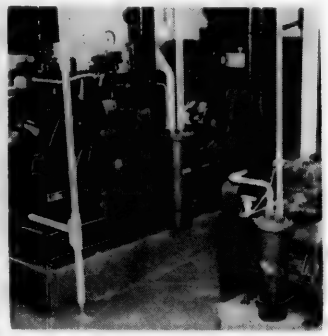
New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

Refrigeration Helps Study Hot Box Problems

PROBLEM: The increase in number of hot boxes in freight car service in recent years required a satisfactory solution.

SOLUTION: At American Brake Shoe Company's new bearing laboratory at their research center in Mahwah, N. J., a Worthington refrigeration system provides and maintains correct temperatures for studying the performance of journal bearings in railroad use and various lubricating methods to eliminate the so-called hot box problem. A Worthington refrigeration compressor driven by a 40-hp motor is used for obtaining large temperature drops in the test room and for holding it at very low temperatures. A smaller compressor driven by a 5-hp motor is used for minor adjustments in temperature and for holding at values only slightly below outside room temperatures. Any selected temperature setting is automatically maintained in the test room through controls actuated by thermocouples located throughout the test room. The operator handles the controls in a separate room and looks directly into the test room through a thermopane window. A system of weights can exert up to 20,000 pounds of load on a journal while hydraulic loading permits applying as much as 40,000 pounds to the journal bearing.



RESULTS: American Brake Shoe's new laboratory, using precise temperature and loading controls, expects to find a satisfactory solution to the increasing hot box problem in freight car service.

Factory Boosts Efficiency with Air Cooling

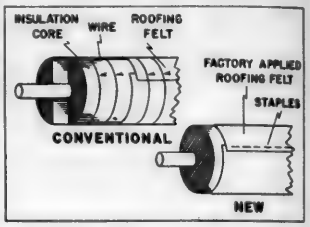
PROBLEM: Anchor Slide Fastener Corp., planning a move to new quarters and a production schedule of 20 hours a day, decided to air condition their new Westbury, Long Island plant. The decision was based on experience in a downtown New York City plant where temperatures would run well over 100F on hot summer days when machinery was in operation. Night shift employees particularly exhibited sluggishness and general discomfort during these periods.

SOLUTION: The new plant's air conditioning system, designed and installed by the Mid-Island Utilities Co. of Westbury, uses a 40-ton self-contained unit manufactured by U. S. Air Conditioning Corp. This unit serves the main production section where conditioned air is distributed by a conventional duct system. Three 7½-ton units are used to serve office and smaller production areas in the building.

RESULTS: Employee efficiency and morale have been substantially increased during the summer months.

Insulation Installed by New Method

PROBLEM: Conventional methods of attaching magnesia insulation to piping at one of the plants of the duPont Finishes Division involved the stripping of light canvas from the insulation, fastening to the pipe with wires, wrapping a felt jacket around the insulation, and wiring in place. The method proved extremely costly because of the extensive requirements for applying or replacing insulation.



SOLUTION: A new method makes use of magnesia with factory applied roofing felt. Sections of insulation are clapped on the pipe after which laps of felt are cemented into position and then stapled.

RESULTS: It has been determined that the new method saves 6 to 7 minutes per foot of insulation. In one year, the plant saved in excess of $11,000 after the stapling procedure was adopted.

Rubber-Plastic Pipe Beats Corrosion

PROBLEM: At the Culligan Soft Water Service of Winona, Minn., where water softening service tanks are washed, regenerated, and sterilized, metal pipe had been seriously corroded by the brine solution used in processing the tanks.

SOLUTION: Piping system was replaced by pipes made from Kralastic, a synthetic resin-rubber plastic produced by Naugatuck Chemical Division, United States Rubber Co. The plastic pipe, made by Anestite, Inc. of Chicago is not attacked by brine and will not support electrolytic action. Installation of the plastic pipe was simplified through the use of solvent-welded fittings. The fittings, made by Tenco, Inc., of St. Paul, Minn., were used to join plastic to plastic and also plastic to metal. The plastic-to-metal fittings were used to join the pipe to brass gages used in the system.

RESULTS: It was the plumber's first experience with plastic pipe, but he completed the installation in less time than would have been needed for metal pipe. The Kralastic pipe is standing up well and looks as though it will last several years, according to the plant operator, who added that he also liked the plastic pipe layout because changes in the installation could be made quickly with a hacksaw, some fittings, and solvent cement.

V-103
Coil Valve

D-251
Piston Damper
Operator

T-800
Remote Bulb
Thermostat

T-400
Room
Thermostat

C. A. Norgren Co., Englewood, Colorado. Stanley Morse, architect; K. J. Murray, consulting engineer; Bell Plumbing & Heating Co., heating contractor, all of Denver.

One of the most modern manufacturing and office buildings recently constructed in the Denver area is the C. A. Norgren Co. building at Englewood, Colorado.

Precision regulation of the heating and air conditioning systems is provided by a specially planned system of Johnson Automatic Temperature Control. The building is heated by radiant panels and convectors. Room by room comfort is assured by strategically located Johnson *Individual Room* Thermostats which operate valves on the water supply to the panels and convectors.

Behind the scenes, other Johnson Thermostats operate Johnson Valves and Damper Operators on the four central fan heating and air conditioning systems which serve the executive, sales and general offices, the engineering department and the lobby area.

All control apparatus is combined in a single "Planned-for-the-Purpose", "Installed-for-the-Purpose" control system resulting in maximum comfort and savings from every heating and cooling dollar spent.

Johnson Automatic Control Systems are always designed specifically for each individual installation. Let a Johnson engineer from a nearby branch office provide the answer to your temperature regulation problems. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

In the engineering department, Johnson *Individual Room* Thermostats maintain ideal working temperatures by operating convector valves and regulating the supply of conditioned air.

Johnson Thermostats on one of the central fan air conditioning units regulate the fresh air supply and control the temperature of the conditioned air. The thermostatically controlled steam valve provides a constant discharge temperature in the heating season.

JOHNSON CONTROL

TEMPERATURE ⇅ AIR CONDITIONING

MANUFACTURING • PLANNING • INSTALLING • SINCE 1885

Laundry Lint Removed by Traveling Screen

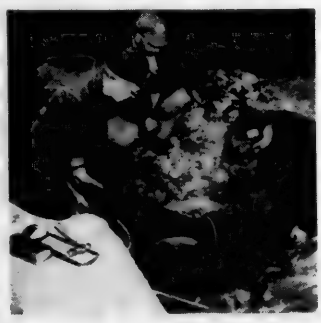
PROBLEM: Lint released by laundry and dry cleaning air dryers used in large commercial laundries, hospitals, and institutions create a definite nuisance not only due to settlement on the roof with its potential fire hazard, but during the summer months from floating into open windows in offices, homes, and factory space. Screens are sometimes used to collect some of the lint, but the maintenance required is in the order of four man-hours per week to clean a screen.

SOLUTION: 14,500 cfm is being exhausted from 15 American Laundry Machine Zone Air Drying Tumblers at the University of California, Teaching Hospital, Berkeley, Calif., through an 8-80 American Air Filter Auto-Airmat. The lint is collected on Airmat paper that is transported on a continuous screen down the face of the filter and rolled automatically at the bottom of the screen. The lint and dust collected during the time the paper is exposed in the air stream are rolled up with the paper eliminating any disposal problem. The frequency with which the curtain moves and the distance it travels is controlled by a pressure switch in the drive motor circuit. This switch is actuated by the resistance differential across the filter curtain and starts the paper moving when the pressure drop reaches 1 inch w.g. The drive mechanism stops when enough fresh Airmat medium has been introduced to lower the resistance to ¾ inch. w.g.

RESULTS: The Auto-Airmat with its high collection efficiency is removing the lint from the air stream thereby eliminating both the nuisance angle and fire hazard.

Planting Plant Solves Acid Drainage Problems

PROBLEM: A new plating plant of the Cadillac Division of General Motors Corp., Detroit, had to be designed to handle great amounts of corrosive fluids and acids used in the plating process. One of the major problems to be solved during construction of the new plant was the conduction and disposal of such fluids which included chrome solutions and sulphuric acid in high concentration. A material for drainage piping was required which would be resistant to the corrosive action of the fluids.



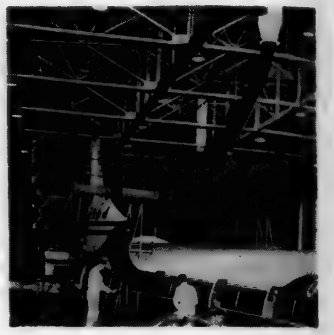
SOLUTION: The material problem was solved when Screw-Seal industrial clay pipe manufactured by The Robinson Clay Products Company of Akron, Ohio, was recommended as a permanent acid-resisting installation. Extra strength clay pipe and its connections are resistant to most chemicals and gases including sulphuric acid at any concentration.

RESULTS: Installation of the system was greatly simplified. Clay sections of pipe screwed together with collars, and joints remain tight despite deflection from frost heave.

Flexible Hose Ventilates Aircraft During Overhaul

PROBLEM: During overhaul operations calling for repainting of aircraft interiors ventilation was required to remove paint fumes which were forcing maintenance mechanics to halt interior work and wait outside until painting could be completed.

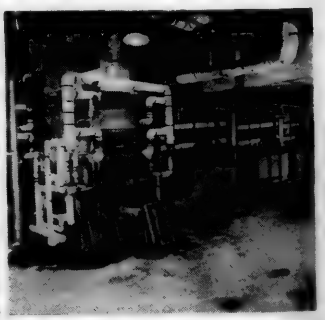
SOLUTION: At the United Airlines maintenance base in San Francisco, lengths of Flexaust hose, product of the Flexaust Company, N. Y., were attached to suction fans in the shop roof and connected to cabin windows. Hose is 18 inches in diameter and 25 feet long. Whenever paint spraying starts, the fans are turned on and perform like vacuum cleaners to remove fumes from cabins within minutes.



RESULTS: Maintenance mechanics now carry on their operations continuously even while paint is being applied.

Constant Atmosphere Protects Plastic Quality

PROBLEM: In urea and melamine resin manufacturing, American Cyanamid Company found that constant atmospheric conditions of 80F and 40 grains of moisture per pound had to be maintained to protect physical properties of the product. Although not in equilibrium with the product, these conditions were determined experimentally to yield the optimum moisture regain.



SOLUTION: Because of the low absolute humidity required, building construction in the Wallingford, Conn., plant includes vapor sealing to impede the flow of air moisture through the walls, floor, and roof. The conditioned area covers two floors, and conditioned air is distributed from a central system to eight zones. Air moisture reduction, before sub-cooling or reheating to meet conditions in each zone, is accomplished in three Kathabar humidity conditioners. These units handle 45,000 cfm of air, and each has the capacity to remove 1600 lb of water per hour. Approximately 45,000 cfm of air is mixed with outside air to maintain the desired conditions.

RESULTS: Dehumidifiers maintain conditioned air at a constant moisture level for protection of the physical properties of plastics during their manufacturing.

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for schools, factories, hotels, hospitals, office buildings, apartment houses, etc.

INSTALL IT AT NO TIME-LOSS

. . . fits through undersized door openings

. . . avoids annoying head-room snags

. . . eliminates costly alterations

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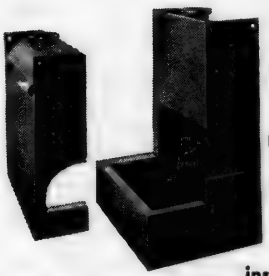
Portmar modern heating systems economically deliver steady steam and abundant year round hot water—automatically fired with oil or gas.

12 Sizes—876,000 to 5,100,000 BTU/hr.
3,650 to 21,250 sq. ft. steam
5,840 to 34,000 sq. ft. water

Larger sizes on request

For complete and thorough cleaning all tubes are accessible through front flue doors

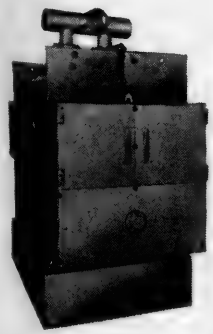


STURDY SECTIONAL CONSTRUCTION

requires no welding in the field

. . . simple, fast assembly is assured — just bolt-up and install two watertight sections!

CLOSED VIEW



Wherever complex heating problems must be solved, the Portmar Type "C" is the answer. An engineered advance in steel boiler design, proved in installations throughout the country, the Type "C" is delivered in *two watertight sections*, requiring *no welding in the field*, correctly specified for easy entrance into the building and for quick hookup to the radiation. It will be rigged right at the breaching on the job, with return and feed headers supplied—ready to start piping at minimum expense! *Portmar steel boilers are known for exceptional economy, expert workmanship and quality materials.*

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. . . low-waterline and low header connections contribute to quiet, economical heating efficiencies.

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. . . built in accordance with the requirements of the A.S.M.E. Boiler Construction Code.

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What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

PIPE runs can be formed through the use of straight pipe runs and special angle fittings, or the use of some of the fittings can be eliminated by pipe bends. There are various bending techniques for the metal pipe found in industrial plants, some simple and some somewhat more complex. Bends can be made by a cold-bending process or by heating the pipe as a preliminary move to a succeeding operation.

This Month's Problem

We have some 1½-inch diameter high-nickel alloy pipe that we would like to form with medium radius bends. As we do not have the necessary heating furnace for making hot bends, can you please tell me how such bends can be made with cold pipe and a filler?

How to bend high-nickel alloy pipe without the need for heating the pipe is described in answer to a query that was submitted by a plant engineer concerning the method for making such bends.

Should you have a problem that you would like to see discussed in this department, or if you have some comments that you would like to add to the discussion scheduled for a coming issue, you are invited to write to the Editor. Such letters are always welcome.

This Month's Problem

The following information on the cold bending of high-nickel alloy tube is made possible through the Development and Research Division of The International Nickel Company.

The overall rule for cold bending annealed tube up to 2½ inches diameter with the aid of a filleter can be expressed as follows: Tube can be bent to a mean radius of 1½ to 2 times the O.D. of the tube or greater, providing the wall thickness of the tube is not less than 5 per cent of the O.D. of the tube.

The preferred filler materials for cold bending nickel and high-nickel alloys are the low melting point alloys such as Tuballoy, Cerrobend, Woods Metal and Cerrobase. Tuballoy and Cerrobend melt at about 160F, while Cerrobase melts at about 250F. Manufacturers of Cerrobase and Cerrobend recommend that Cerrrobend be used for tubes up to 1¾-inch diameter and Cerrobase for larger diameter tubing. These alloys shrink slightly upon solidification, which shrinkage is offset by dimensional growth at room temperature. This growth tends to assume the elimination of voids within the filled tube. Sand is not a satisfactory filler material for bending because it is practically impossible to pack the tube tightly enough to prevent some cave-in during bending, which results in a kinky bent tube.

As a preparation for bending, the tube is cleaned thoroughly and one end of the tube is closed with a wooden or a rubber plug. The tube is filled with a light oil of low sulfur content and then is drained out so that a thin film of oil is left inside the tube. This keeps the filler from tinning the tube's inside surface. When filling, the tube should be held in a vertical position. After the tube has been filled with the molten metal, it should be immediately cooled with cold water. The preferred cooling procedure is to plunge the tube while in an upright position into a circulating water tank and to hold it there until completely cooled. Should there be no quenching facilities, then flush or hose the filled tube with cold water, starting from the bottom and working upwards. Rapid cooling, as described, is essential to obtain a cast structure in the filler alloy possessing cold ductility suitable for bending.

The filled tube is warmed to about 100F and is bent with slow uniform pressure over a forming block or in a conventional bending machine. After bending, the filler alloy is melted and run out of a tube by heating the filled tube in boiling water. Do not use a torch as a heating medium for melting the solidified filler material. Cerrobase can be melted by heating the tube in a hot oil bath held at about 325F.

Use of a low sulfur oil and removal of all traces of the oil from the tube's surface is recommended. If an oil of questionable sulfur content is used, it is mandatory that every trace be removed. Upon complete removal of the filter, the tube is flushed out thoroughly with a solvent to remove all traces of the oil with which it was filled initially. The tube is flushed with a hot (180-200F), 10 to 20 percent solution of trisodium phosphate or sodium carbonate followed by thorough rinsing in water to remove any film of the solvent that might have remained. Then the tubes are cleaned with a hot alkaline solution of 180-200F. To make this solution, add 10 to 20 percent of trisodium phosphate or washing soda to water. All

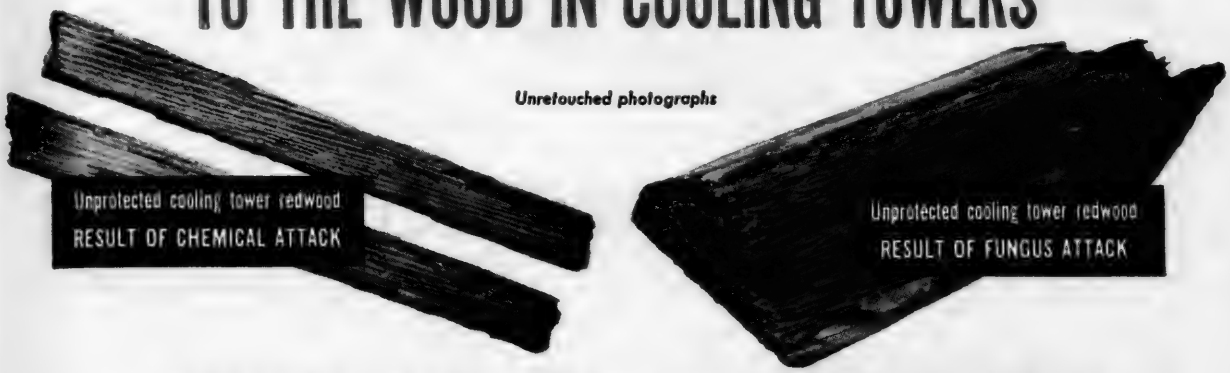
(*Continued on page* 144)

Problem for the Coming Issue

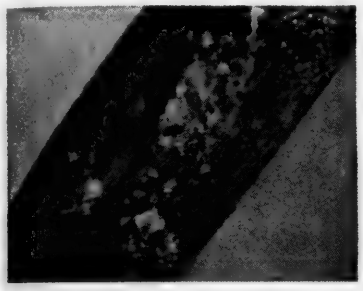
I would appreciate whatever information you may have regarding accepted methods for hanging ducts. Are there any regulations regarding the design of access doors for ducts?

LOOK WHAT CAN HAPPEN TO THE WOOD IN COOLING TOWERS

Unretouched photographs


Unprotected cooling tower redwood
RESULT OF CHEMICAL ATTACK
Unprotected cooling tower redwood
RESULT OF FUNGUS ATTACK

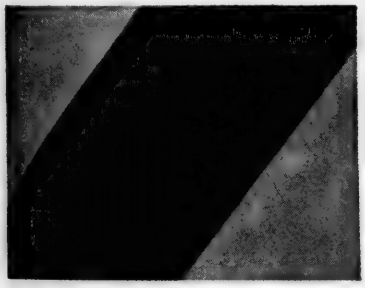
PRESSURE CREOSOTING ADDS YEARS OF LIFE TO HALSTEAD & MITCHELL COOLING TOWERS



FUNGUS ROTTED UNPROTECTED DECKING

Unretouched photographs

CLEAN PRESSURE-CREOSOTED DECKING



Examine these unretouched photographs carefully. Constantly wetted wood decking in a cooling tower is subject to immediate attack by fungus and marine parasites. It is also subject to chemical deterioration from acids in water. All wood used in Halstead & Mitchell Cooling Towers is protected against these twin enemies.

WHY PRESSURE CREOSOTING?

Creosote . . . *with 162 elements toxic to fungus growth and parasites* . . . also makes wood more resistant to chemical attack. Deep penetration of the wood by Koppers Pressure-Creosoting gives the longest possible wetted decking life. Therefore, all Halstead & Mitchell Cooling Tower decks are Pressure-Creosoted, and are guaranteed against rotting due to fungus growth . . . for 20 years!

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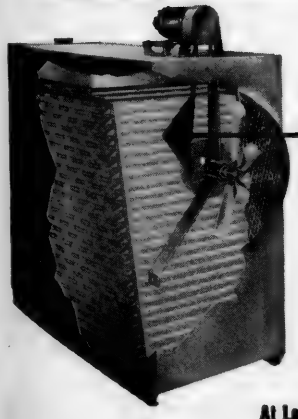
20-Year Guarantee!

ON THE WETTED DECK SURFACE against rotting by fungus attack



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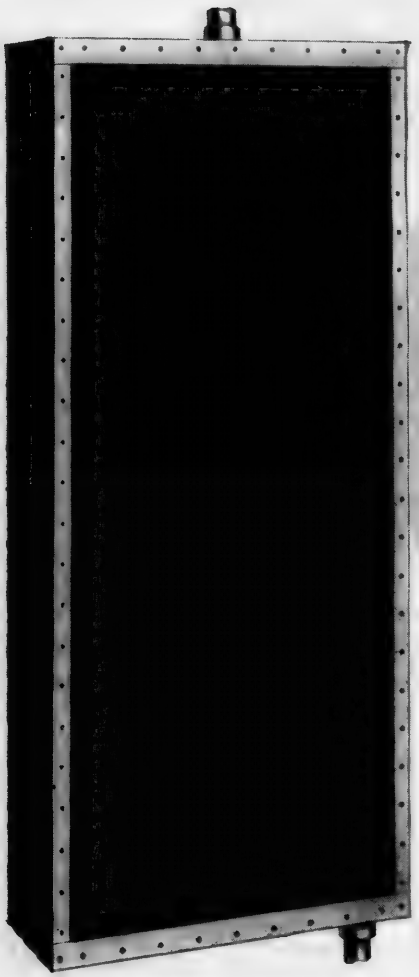

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NEW CATALOGS

PACKAGED STEAM GENERATORS—Bulletin MH 3-54, published by Union Iron Works, Erie, Pa., gives detailed coverage to the company's Type MH packaged water tube steam generators, furnished for oil or gas firing or both, with automatic, semi-automatic or manual combustion controls. Included are cutaway illustrations, installation photos, tube arrangement layouts, a photo-sequence story of actual shop assembly construction, auxiliary equipment available and a well-defined dimension table for 13 standard sizes ranging in capacity from 10,000 to 40,000 lb. of steam per hr. .....Item 101

IN-PLANE BENDING PROPERTIES OF WELDING ELBOWS—Bulletin 534 of Taylor Forge & Pipe Works, Chicago, Ill., is a reprint of ASME Paper No. 53-A-70, In-Plane Bending Properties of Welding Elbows. The purpose of the paper is to provide design engineers with accurate, experimentally derived flexibility and stress intensification factors applicable to welding elbows commonly used in high pressure steam, oil refinery and gas compressor station piping systems. It is aimed at filling a new existing gap in the design information available for a class of fitting having wide industrial use. .....Item 102

ROOM CLEANER KEEPS LINT FROM ACCUMULATING—Bulletin 254 of Parks-Cramer Co., Fitchburg, Mass., describes the Type CTR-7 room cleaner for mills spinning both cotton and cut synthetics. This motor-driven blower unit travels at 100 fpm on a two-rail track above head height with the air distributor revolving in a complete circle every six seconds. The cleaner is said to keep lint from accumulating on structure, machinery, and low down areas. .....Item 103

CONDENSER—A folder describing the model DRS Freon Condenser of Doyle & Roth Mfg. Co., Inc., Brooklyn, N. Y., contains specifications, charts and illustrations, and lists other products of the company. .....Item 104

BLOW-OFF VALVES—Catalog 12-D1 published by Edward Valves, Inc., subsidiary of Rockwell Mfg. Co., Chicago, Ill. features a redesigned line of blow-off valves with flanged or welding ends and bolted bonnets for 300, 400-600, 900-1500 lb. sp classes plus the addition of welded bonnet blow-off valves with welding ends for 1500 and 2500 lb sp classes. The catalog is illustrated with installation photographs, descriptive line drawings and cutaway views. Tables on material specifications, flanged and welding end details as well as valve descriptions and a partial list of current users of Edward steel blow-off valves are included. .....Item 105

LOW COST REFRIGERATION—A reprint (Form 9173) of an article on steam-jet water vapor refrigeration is available from Ingersoll-Rand Co., New York, N. Y. It explains how a large tire manufacturing firm solved its chilled water problems by installing an 1140 ton unit of the water-vapor type. The article explains how this system was chosen in preference to a mechanical refrigeration plant on the basis of an economic evaluation which showed the water vapor system lower in first cost, attendance cost, installation cost, maintenance cost, power cost, and piping cost than conventional systems. .....Item 106

MOTOR PRICE LIST—A folder, which contains the price list of its comprehensive line of motors, has been issued by Howell Electric Motors Co., Howell, Mich. Dimensional data are also included. .....Item 107

LUBRICATED PLUG VALVES—A 24 page reference book No. 39-5, showing its lubricated plug valves in full-port and venturi types, sizes up to 14 inches, and with a choice of self-sealed two-piece plug or one-piece plug designs, is published by Homestead Valve Mfg. Co., Corapolis, Pa. Engineering information includes principal dimensions, types of control, metals, and lubricants. .....Item 108

TURBINES—A 16-page Bulletin, H-22, on its Type YR Mechanical Drive Turbine, is issued by Elliott Co., Jeannette, Pa. The bulletin gives emphasis by large, detailed illustrations to design features and proper control of mechanical drive turbines. Modifications, specifications, and dimensions are detailed. .....Item 109

PROCESS TIMERS—An eight-page bulletin, GEC-1223, on a new process timer, is available from General Electric Co., Schenectady, N. Y. It describes the operation, advantages, and applications of the company's new type TSA-18 process timer. Included also are connection diagrams for typical applications, as well as installation and cut-away illustrations, prices, specifications, and dimensions. .....Item 110

COOLING TOWERS—A new commercial cooling tower catalog, containing a wealth of new material on air-conditioning cooling tower applications, specifications, selection and installation, is issued by Halstead & Mitchell, Pittsburgh, Pa. The 16-page catalog, WT & CT-553, describes the operating characteristics of twenty standard commercial cooling towers, ranging in capacity from 5 through 60 tons. Several pages are devoted to tables, drawings and graphs. Information covered includes a comprehensive table of cooling tower nominal ratings for both 75 deg and 78 deg wet bulb temperatures, outlet water temperatures plotted against wet bulb temperature tower capacity plotted against wet bulb temperature, layouts for year-'round operation and inside use, and much additional data. .....Item 111

AIR DIFFUSERS—Three attractive, two color, four page catalogs on its air diffusers are issued by Air-Factors, Inc., Monrovia, Calif. The B60 ceiling type air diffusers are covered in Catalog B60-101; LCF sidewall air diffusers are shown in Catalog LCF-AS-101. Catalog [illegible] is devoted to ceiling air supply outlets for evaporative cooling systems. .....Item 112

HEATING SPECIALTIES—A new catalog showing the new Flo-tee fittings, Venturi Tees, Equa-Trol manifolds, baseboard heat accessories, and Equa-Valves, is available from Hi-Flow Products, Inc., Baltimore, Md. .....Item 113

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READERS' SERVICE DEPT.

AIR CONDITIONING TIPS — A folder, What's the Big Idea in Air Conditioning in '54?, points out opportunities for profit created by the growth of air conditioning sales. Published by The Arrow-Hart & Hegeman Electric Co., Hartford, Conn., the folder contains important suggestions on upgrading air conditioning wiring jobs and tips on selling adequate wiring in homes and offices. .....Item 114

VERMICULITE FOR BUILDING INSULATION—A 7-page booklet entitled Vermiculite Loose-Fill Building Insulation is issued by Vermiculite Institute, Chicago, Ill. It describes the properties of the fireproof material and manner of installation. Procedures are illustrated with typical construction details. Data, said to be authenticated by a nationally known consultant, give potential savings in fuel and summer air conditioning costs. Sketches and photographs are included. ...Item 115

FILMING AMINES IN BOILER FEEDWATER ALKALINITY—Experiences with Filming Amines In Control of Condensate Line Corrosion is the title of Technical Paper No. 127, prepared by W. H. & L. D. Betz, Philadelphia, Pa. Attributing condensate line corrosion chiefly to the presence of carbon dioxide in the steam and water, various methods of minimizing boiler feedwater alkalinity are discussed, especially the employment of filming amines. This new approach to the problem is based on the deposition of a non-wettable film on the metal which is impervious to penetration by the condensate. Field results under various conditions are reported. .....Item 116

AIR CONDITIONING SYSTEM—Bulletin C-4.27 of Drayer-Hanson, Inc., Los Angeles, Calif. describes the Spotaire zone-controlled, refrigerated air-conditioning units designed for schools, offices, churches, stores, restaurants, beauty shops, cocktail lounges, and auditoriums. When connected to water piping circulating hot or cold water, the unit will heat in the winter, cool in the summer, giving individual room control the year 'round. Also available for direct expansion refrigeration. It is easily installed and serviced. .....Item 117

DEMINERALIZATION OF WATER—Said to be the most comprehensive editorial treatment ever accorded the subject of demineralization in a company publication is contained in a 24-page Bulletin WC-111 available from Graver Water Conditioning Co., New York, N. Y. Chemical and mechanical factors entering into the design and operation of demineralizing plants for obtaining the highest quality process water and boiler feedwater from a wide range of water supplies and under many different operating conditions are fully explained. .....Item 118

SQUIRREL-CAGE MOTOR SELECTOR—Designed to help in quickly choosing squirrel cage induction motors, both the new line and the current line, for applications ranging from 1 to 200 hp., a 12-page bulletin, B-2102, is issued by The Reliance Electric and Engineering Co., Cleveland, Ohio. Termed a Motor Selector, the new bulletin lists performance characteristics, construction features, dimensions, price, and information essential in ordering the "right motor for the job." .....Item 119

AXIAL-FLOW FANS—Axial-flow direct-connected exhaust fans are fully illustrated with performance charts, specification sheets, and application data in Bulletin 500 of M & E Mfg., Co., Indianapolis, Ind. Roof exhausters and penthouses complete this new full line of exhaust fans designed to provide positive exhausting of fumes as well as cooling for personnel by means of having air move over people. Application of this positive displacement fan is made in new construction, garages, factories, restaurants, power plants and wherever the necessity exists for proper movement and distribution of air for health of employees. .....Item 120

TEMPERATURE EQUIVALENT CHART—A handy pocket size chart of Fahrenheit and Centigrade temperature equivalents is available from Moeller Instrument Co., Richmond Hill, N. Y. The reverse side of the chart illustrates by animated demonstration the easy reading qualities of thermometers made with glass red reading column. Chart is 6½ x 3½ inches in size, easily carried in the pocket or wallet or may be placed under glass desk tops for reference. .....Item 121

AIR-GAS TORCHES—A comprehensive brochure No. 8 covering the large field of air-gas torches is issued by National Welding Eqpt. Co., San Francisco, Calif. Since many public utility companies are now converting from a manufactured to a natural gas or have done so, this brochure is of increased interest and importance, since flame applications of all sorts are increasing in industrial plants. .....Item 122

SELECTOR FOR POWDER ACTUATED TOOLS—A pocket-sized slide-rule type selector which gives at-a-glance guidance in the proper selection of fasteners, discs and charges used with powder-actuated tools, is available from Ramset Fastenere Div., Olin Industries, Inc., Cleveland, Ohio. The selector, constructed of laminated cardboard, is designed so that an immediate cross-line reading can be obtained by matching a sliding scale indicator with hardness and thickness data for each use in steel or concrete. Reference tables also indicate the proper charge. .....Item 123

AIR CONDITIONER TIME SWITCH—A new 16 page booklet No. NR44, describing automatic control for room air conditioners, is available from International Register Co., Chicago, Ill. While most air conditioners are equipped with a temperature control, they do not have the automatic time control feature which turns the unit on and off at preset times. Automatic control can be achieved by merely plugging the air conditioner into the company's time switch. The results provide greater comfort and convenience to the user, longer life for the unit, and a saving on the electric bill. Booklet explains automatic control in detail and gives description and technical data on the new Skipper portable plug-in time switch. ....Item 124

INDUSTRIAL THERMOMETERS—A 11-page catalog No. 101 describes and illustrates the new Gotham line of industrial thermometers made by United States Gauge Div. of American Machine and Metals, Inc., Sellersville, Pa. It includes complete specifications on the new Multi-Angle industrial thermometer which can be rotated and tilted to any practical mounting angle and locked securely in position by a few turns of one nut. A helpful temperature equivalent table is printed on the inside back cover. .....Item 125

SOLDER-JOINT FITTINGS—Catalog and price list LMC-7-F has been issued by Lewin-Mathes Company, St. Louis, Mo., and covering that company's line of wrought and cast solder-joint fittings for copper tube. Both the wrought and cast line are most comprehensive. Bulletin includes instructions for making solder-joint fittings with copper tube. ....Item 126

AIR CONDITIONING UNITS—Catalog No 1630 on air conditioning units is issued by Westinghouse Corp., Boston, Mass. The 40-page catalog is divided into five separate data sections: descriptive, performance, layout, engineering, and service. Air conditioning units are covered ranging from 1200 cfm to 21,000 cfm air volume; cooling capacity from 20,000 Btu per hr to 2,000,000 Btu per hr. Of further aid to the plant engineer are typical specifications for a guide in selecting units for a particular installation. .....Item 127

SAFETY RELIEF VALVES—Catalog 53 on Mipco safety relief valves, boilers, compressors, heat exchangers, pressure piping, and other equipment, is issued by Marine & Industrial Products Co., Philadelphia, Pa. .....Item 128

AUTOMATIC CONTROL SYSTEMS—A new bulletin, F 5265-1, giving complete information on its Electric Control Centers, is available from Barber-Colman Co., Rockford, Ill. How to improve the installation of controls for heating, ventilating, and air conditioning with automatic electric Control Centers is clearly explained for easy understanding. This new bulletin points out how everyone all along the line, from the property owner to the engineer and electrician, can benefit from such a centralized system. With this system, the engineer can prepare adequate specifications in a minimum amount of time. Complete, easy-to-understand specifications allow the contractor to prepare an exact bid which may reflect a lower cost, because he knows the correct amount of material required. .....Item 129

PLEASE SEND US MORE INFORMATION

Write in, below, the item number on which you wish further information —

Item No.	Item No.	Item No. .....
Item No.	Item No.	Item No. .....
Item No.	Item No.	Item No. .....

This service available only to U. S. and Canadian readers.

PLEASE PRINT

July H-54

Name .....

Title .....

Firm .....

Nature of Firm's Business .....

Street .....

City ..... Zone..... State.....

This card is void after Oct. 1, 1954

An engineer from Quinn & Feiner, Refrigeration and Air Conditioning contractors, shown checking the largest reciprocating compressor installation in the East.

McCrory's

IS A PLEASANT PLACE TO SHOP

p·k COOLERS ARE INSTALLED HERE

McCrory's spacious and sparkling new store at Livingston Street in Brooklyn is the world's largest variety store. Careful planning has made it an inviting place to shop.

p·k dry expansion freon coolers, an integral part of the air conditioning system, supply chilled water to eight remote conditioners. Four of these coolers – three in the sub-basement and one on the second floor – provide a total capacity of 350 tons of refrigeration in which they cool 1000 GPM of water to 44 deg. F.

Economical and efficient, **p·k** coolers have earned a place for themselves in commercial and industrial building. A pioneer in the development of many types of heat exchange equipment, **p·k** has provided exchangers for virtually every type of application.

What are your heat exchange needs? Heating? Cooling? Custom built or standard units? **p·k** has a wealth of experience in helping people like yourself select the proper equipment for their particular applications. **p·k** catalog #101-A gives standard range of freon coolers.

the ***Patterson-Kelley Co.,*** inc.

970 Burson Street, East Stroudsburg, Penna.

2526

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities.

NEWS OF THE MONTH

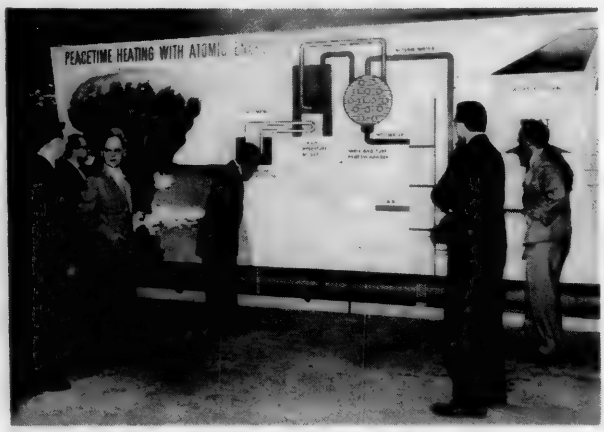
NEW LAB

Creates terrible weather—then helps develop machines to overcome it. Heat transfer featured.

A new research laboratory has gone into operation in La Crosse, Wis., creating samples of "terrible" weather from almost anywhere in the world, and then helping develop the machines to overcome it. The new Research and Testing Laboratory of The Trane Company was constructed for research and product development in the company's fields of air conditioning, heating, ventilating and heat transfer, according to Donald C. Minard, Trane president.

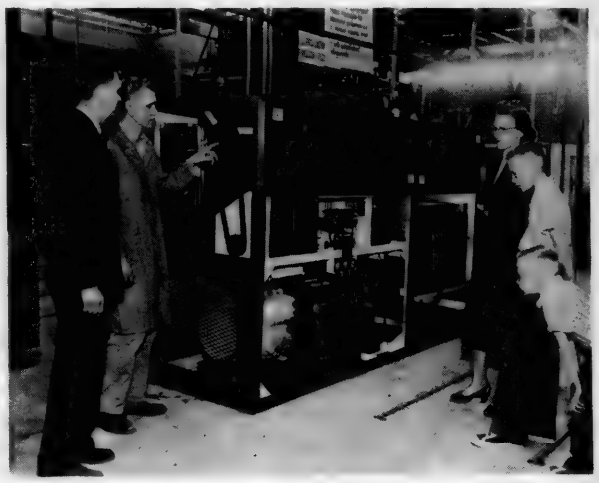
For example, one of its two cold rooms permits the temperature to be driven down to 65 degrees below zero for pre-testing equipment destined for use in arctic or cold storage conditions. At the other extreme is an atmosphere-controlled furnace where the temperature can be raised to 2,500F for research in new methods of fabricating heat exchangers designed especially to cope with the ever-climbing temperatures of new industrial processes and perhaps, too, to help in harnessing of atomic energy.

Open house visitors see how passengers in a "glass house on wheels"—which represents one of the tougher problems in air conditioning—are kept cool under a blazing summer sun explained in this exhibit of a large mockup of a full-dome railway car showing where Trane cooling equipment is located.



Principles of harnessing atomic energy to heat a building are shown in schematic drawing at new Trane Laboratory. Here's how it works: Liquid metal, heated in an atomic reactor, goes to a steam boiler. Steam goes from the boiler to a heat exchanger, where it heats water. Hot water then goes to a heating coil through which a fan blows air supplying the space.

How to combat cold drafts and stale air in classrooms to help keep children comfortable and alert is demonstrated by this display of a Trane unit ventilator with "kinetic barrier" action. Arrows show how rising tempered air meets and deflects cold air that would otherwise fall on children in nearby aisles.



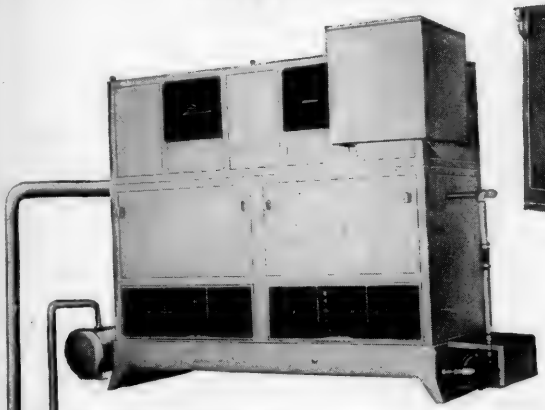
This self-contained air conditioner with its insides revealed through glass panels was an attraction for visitors. A technician points out the fan that sends room air through the cooling coil at left rear of unit, where it is cooled and returned to the room.

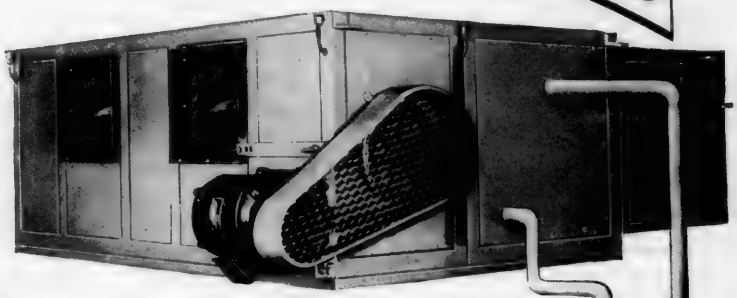
• **SCOPE**— The laboratory is one of the few in the United States devoted exclusively to the science of heat transfer, contributing to solution of problems affecting the public in many ways.

Scope of the work to which the laboratory may eventually contribute was sketched at dedication ceremonies in May by Robert LeBaron, assistant to the secretary of defense (atomic energy) and chairman of the military liaison committee of the atomic energy commission.

(*Continued on page* 130)

THE KENNARD *Engineered* LINE COMPLETES THE JOB





KENNARD AIR CONDITIONING BLOWER UNITS

are adaptable to all forms of air conditioning installations. 13 sizes, 400 to 21,600 C.F.M. Vertical or Horizontal.

KENNARD EVAPORATIVE CONDENSERS AND COOLING TOWERS

meet present day demands for effi cient water saving. Rugged enough for Outdoor, quiet enough for Indoor, 3 to 75 tons.

Complete the job with other KENNARD products

Coils—Cooling or Heating.
Multi-Zone Air Conditioning Units
Heating and Ventilating Units
Sprayed Coil Dehumidifiers
Cooling Towers

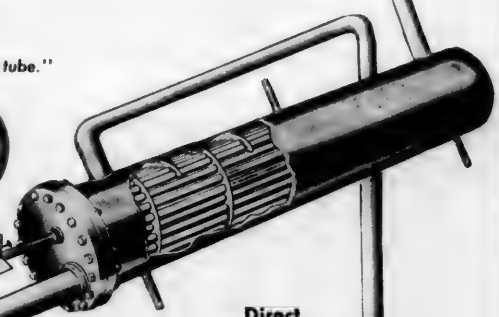
OUR 20th YEAR
AIR CONDITIONING EQUIPMENT
1934 1954
KENNARD CORPORATION
ST. LOUIS MISSOURI

"It's in the fin and the fin is in the tube."

Cross Section of Chiller Tube developed by KENNARD.

Pat. Applied For.

Valve (by others)

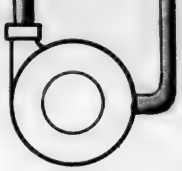


Direct Expansion Freon 12-22

KENNARD SHELL AND TUBE LIQUID CHILLERS

Revolutionary internally finned tubing (exclusive with KENNARD) makes them better than 50% lighter and smaller—positive oil return—no Freon head gasket—smaller Freon charge. Sizes 2 to 200 tons.

Compressor *(by others)*



Pump *(by others)*

KENNARD CORPORATION
1823 S. HANLEY RD. • ST. LOUIS 17, MO.

NEW LAB

(*Continued from page* 128

In the path of discovery, Mr. LeBaron told a dedication preview audience, are many new branches of industrial technology including atomic energy, jet aircraft, guided missiles, space travel, electronics, radar, low temperature, and many others of a wide variety. "In all of these," Mr. LeBaron said, "there is the common denominator of heat transfer."

• **FEATURES.**—Unusual features of the laboratory include a room-within-a-room where the outside chamber is refrigerated or heated to simulate outdoor conditions and enable testing and rating of heating and cooling equipment in the inner room.

A sound-proofed room makes it possible to check Trane air conditioning and ventilating units for quiet operation, especially important for installations such as schoolrooms, hospitals—and desirable in any case.

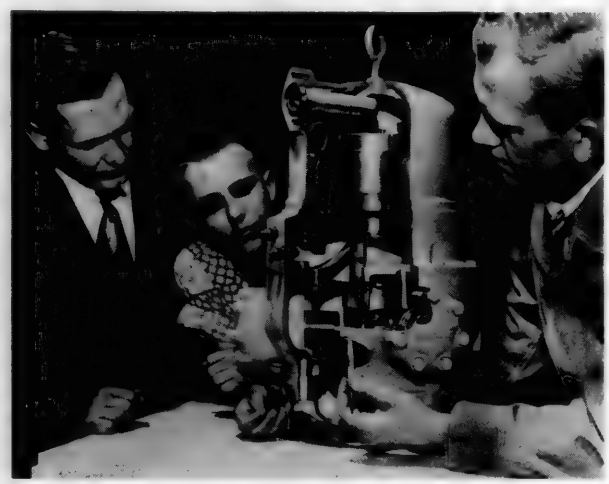
Air tunnels help the design of cooling and heating coils by applying a wide range of tests to establish their efficiency and indicate ways they can be improved still more.

Another area of the laboratory incorporates test facilities for larger equipment such as centrifugal compressors widely used in big-building air conditioning, and centrifugal fans employed for ventilating factories and office buildings. The fan test set-up includes a 45-foot-long wind duct in which gales up to 60 miles an hour may sometimes be created when a fan is on test.

High ceilings of this area also enable testing under practical conditions of the types of ceiling-suspended projection heaters so often used in factories, warehouses, and other large spaces.

In the section which houses the offices and chemical and metallurgical laboratories is an instrument calibration room which technicians call their "Trane bureau of standards." Here are calibrated the delicate instruments used for measurement in connection with the research, ranging from super-sensitive pressure gauges to thermometers.

The thermometers, for example, are made-to-order to Trane specifications, then calibrated to an accuracy as fine as 1/20th of a degree. This is done by immersing their bulbs in an electrically-heated water bath. As the water is gradually warmed, their readings are compared with that of a standard thermometer previously calibrated by the U. S. Bureau of Standards in Washington.



Where cooling comfort comes from in an air conditioning system is explained to visitors viewing this cut-away Trane hermetic compressor on display in the new research laboratory. Technician, at right, points out pistons that compress refrigerant gas.

NDHA

elects L. F. Collins president. Steam main construction stressed at convention.

Leo F. Collins, chemical engineer, Central Heating Department, The Detroit Edison Company, was advanced to president at the forty-fifth annual meeting of the National District Heating Association held at The Greenbrier, White Sulphur Springs, W. Va., May 25-28. About 300 members and guests attended.

• **NEW OFFICERS.**—Other officers for the new term are Thomas P. Brown, Jr., assistant chief system operator, Consolidated Edison Company of New York, Inc., first vice president; Vernon J. Suche, steam utilization engineer Union Electric Company of Missouri, St. Louis, second vice president; Walter M. Gillespie, assistant to manager, Heating Division, The Dayton Power and Light Company, Dayton, Ohio, third vice-president; John F. Collins, Jr., Pittsburgh, Pa., secretary-treasurer.

• **PROGRAM.**—The program consisted of groups of papers arranged as part of the report of special committees and of simultaneous breakfast sessions at which special problems were discussed.

Five papers were presented as part of the session devoted to the report of the Distribution Committee. Resumés of most of these papers follow:

• **MATERIALS FOR STEAM MAIN CONSTRUCTION.**—J. W. McKinley, Denver, Col., last year presented an interim report on materials for steam main construction. This year, a concluding report was prepared by him on Survey to Locate Newly Developed materials for Steam Main Construction. There were reports from some on their experience with gilsonite, and the insulation properties appeared to be good. It is important to lightly tamp the gilsonite after it is in place and to provide forms to confine it, if the earth surrounding it is not solid, so as to prevent the unconsolidated material from flowing away.

An experimental installation of an underground steam service pipe was made using a laminated fiber duct as an inside form for the poured concrete duct. This product was developed for use in place of metal or glazed tile for warm air ducts. The material, which can easily be cut with a knife comes in 18-foot lengths and with inside diameters from 2 to 24 inches.

A study is being made of a new type of pipe insulation for indoor and outdoor applications. The insulation consists of concentric layers of sheet aluminum alloy with ½ inch separations and supported by braided glass or

(*Continued on page* 132)

FOR COOLING · HEATING · VENTILATING...

new Modine Airditioner outpoints them all!

FEATURE	MODINE AIRDITIONER †	CONDITIONER A	CONDITIONER B	CONDITIONER C	CONDITIONER D
Available in 4 types? (Console, concealed, overhead and deluxe ceiling models.)	YES	NO	NO	NO	NO
Number of fan speeds	4	3	3	2	2
Can end panels be removed to facilitate piping?	YES	YES	NO	YES	NO
Is ample space provided for piping?	YES	YES	NO	YES	NO
Is coil easily reversible for right or left-hand piping?	YES	NO	NO	YES	NO
Does design prevent condensate from dripping into fan casing?	YES	NO	NO	YES	YES
Is coil protected from objects dropped thru upper grille?	YES	NO	NO	YES	YES
Are motors lifetime lubricated?	YES	YES	NO	NO	YES
Can power assembly be easily removed?	YES	NO	NO	YES	YES
Is internal wiring done at the factory?	YES	YES	NO	YES	YES
Is front small and easy to remove?	YES	NO	NO	NO	NO
Is offset for toe space provided?	YES	NO	YES	YES	NO
Are two access doors provided?	YES	NO	NO	NO	NO
Are corners square for ease of recessing?	YES	NO	NO	NO	YES
Projection into room when recessed to full depth	6"	Not recessable	7½"	8½"	6"

† *Trademark*

THE QUALITY CHART TELLS THE STORY. Only Modine AIRditioners have all the extra quality features that mean superior cooling and heating . . . longer life . . . quieter operation. For all the facts, see the Modine representative listed in your classified phone book or mail the handy coupon below . . . today!

LOOK! AIRditioner is styled by Jean Otis Reinecke, leading industrial designer. Attractive marine green primer is often used as finish coat. Console model is shown recessed.

LISTEN! You can enter a room in which an AIRditioner is running and hardly be able to tell it is operating. Quiet operation certified by decibel ratings.

Modine Airditioner

MODINE MFG. CO.
1511 DeKoven Ave.,
Racine, Wisconsin

Please send me a free copy of Bulletin describing "The New Modine AIRditioner."

Name .....
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Firm .....
Address .....
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A-1225

NDHA

(*Continued from page* 130)

calcium silicate spacers. The design contemplated would enclose the pipe and insulation on saddle supports in a clay tile conduit.

There are many applications of Foamglas and expanded vermiculate aggregate in constructing underground steam piping. There are a number of reports on how these materials have been used. The paper covered some special applications.

• **STEAM MAIN CONSTRUCTION PRACTICES.**—A paper on Steam Main Construction Practices and Recent Improvements in Design, was prepared by Homer F. Hatfield and John F. West, Jr., of the Pennsylvania Power & Light Company, Allentown, Pa.

A special committee was appointed by NDHA to study recent steam main construction tends in the hope of finding principles and practices which might help reduce steam main installation costs. Costs given in the report are for replacement mains in a central city street and they do not include the cost of valves, traps, drains, reducing stations or manholes, except where required by expansion joints. No attempt was made to evaluate superiority of one design over another.

On these premises, the costs varied about $6 per foot, or about 25 percent of the variable items. Corrugated expansion joints requiring no manholes and poured concrete duct with precast roof slab construction provided the lowest cost combination.

In general, the main cost, including expansion joints and conduits, accounts for almost 90 percent of the total installation cost. Of this 90 percent, about one-half is for items over which there is very little control such as excavation, backfill and services. These costs remain practically the same for all types of construction. Best opportunities for economies are for pipe, type of duct, anchors and expansion—items over which there is some control.

• **DESIGN PRACTICES.**—Ernest T. Smith, The Detroit Edison Company, prepared a paper on Prevailing Practices Regarding Design, Location, Operation, and Maintenance of Service Valves and Their Housings.

The method used by 24 of the 35 companies that reported in this survey for installing services is to weld the service line to the main, run the service line into the building, and then to install the service valve inside the building. This practice covers both high and low pressure systems.

Of nine companies that use service valves at the mains, only three install manholes (high pressure systems). Four companies install valve boxes and two install the outside service valves in existing manholes.

In practically all cases, the company installs the entire service line and the service valves at no charge to the customer.

Where both seasonal and year-round customers are supplied steam from the same mains, 18 companies operate valves for seasonal customers seasonally; 7 companies operate the valves only in emergencies or at customer's request.

• **LIFE EXPECTANCY.**—William E. Lucas, Allegheny County Steam Heating Company, Pittsburgh, Pa., presented a paper on "Underground Steam Lines—Their Life Expectancy". Reasons that affect the removal of steam lines from the ground are deterioration, inadequacy and obsolescence. Depreciation varies from 25 to 60 years. Because of the controversial nature of the paper, much of the information was not available for general use.

SUN ENERGY

converted directly into electricity by devices developed by Air Force and Bell Labs.

The Air Force announced in early June the development of a solar generator that, when refined, could convert sunlight into energy to run a home.

The Air Research and Development Command said the new generator had been evolved through research conducted by Donald C. Reynolds and Lieut. Col. Gerard M. Leies.

• **TRANSISTORS.**—On April 25, the Bell Telephone Company unveiled a solar battery that converts sunlight into electricity through silicon transistors. Light striking thin strips of silicon creates a flow of electric current in atoms in the strips. Both the Bell device and the Air Force generator are capable of converting energy taken from the sun.

The Air Force generator uses a crystal form of cadmium sulfide, a yellow powder employed as a pigment in the manufacture of paint. The pilot model supplies a charge of one quarter of a volt and can operate an electric clock.

HPACCNA

elects J. DeWitt Morrow of Houston president. Total annual business of members about $1.25 billion

New president of the Heating, Piping and Air Conditioning Contractors National Association is J. DeWitt Morrow, Houston, Texas, president of the Warren Company, mechanical specialty contractors. Elected to serve as vice president for the 1954-55 term was Edward Jungbert, Coral Ridge, Ky. New treasurer of the nationwide association is George Hall, Madison, Wisc.

A total attendance of nearly 600 registered for the four-day 65th Annual Convention of the HPACCNA, held in Atlantic City's Traymore Hotel, at the end of May. Heavy attendance at panel discussions and open sessions was evidence of the continuing interest in such important industry subjects as pipe welding, air conditioning, refrigeration, corrosion, apprenticeship and market research. Martin P. Durkin, general president of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U. S. and Canada was a featured speaker on the subject of apprentice training.

• **OVERHEAD SURVEY.**—Results of the Annual Overhead Survey for 1953, sent to members of the Heating, Piping and Air Conditioning Contractors National Association, were released.

A response of 176 of a total of over more than 1,200

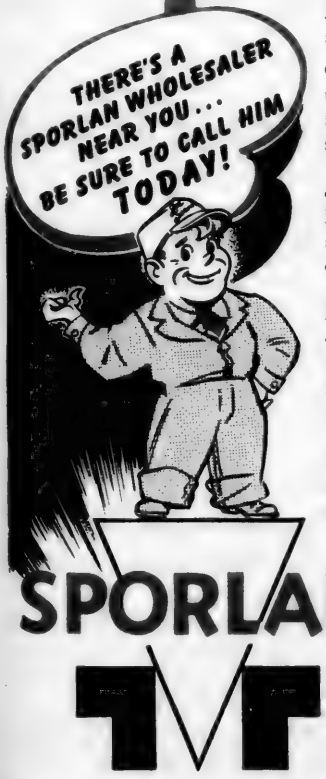
(*Continued on page* 134)

for PEAK PERFORMANCE on All Air Conditioning Systems

buy Sporlan right down the line!

and by Right Down the Line Peak Performance we refer to

4 VITAL ITEMS *that can Make or Break any Air Conditioning System!*



Let's look at item No. 1... The Filter-Drier! Clean, dry, acid-free, sludge-free refrigerants are yours when you use a Sporlan Catch-All!

Only Sporlan can offer you the Catch-All, the perfect filter-drier with the molded porous core. It offers the greatest filtering area, and the highest degree of activation for the removal of acid, water, sludge and foreign particles. It cannot powder. It cannot pack, and it dries the refrigerant to an end point so low that any remaining moisture is absolutely harmless!

Sporlan also offers you the perfect answer in item No. 2... Solenoid Valves! Nothing can touch the Peak Performance of Sporlan Solenoid Valves. They're tight closing, their coils are layer wound (not random wound), they're so well insulated, so moisture proof, that they defy electrical failure!

Item No. 3... The Thermostatic Expansion Valve is important, too! For maximum evaporator capacity at all times, it is essential to eliminate hunting in air conditioning valves. Fortunately, thanks to Sporlan's FLOW MASTER element, you will never have to worry over alternately flooded and starved evaporators again... just order a Sporlan valve with FLOW MASTER element and Peak Performance is yours!

But, how about item No. 4... The Refrigerant Distributor? To get Peak Performance in all evaporators, Sporlan distributors have a perfectly designed nozzle and conical button to assure uniform distribution to all circuits.

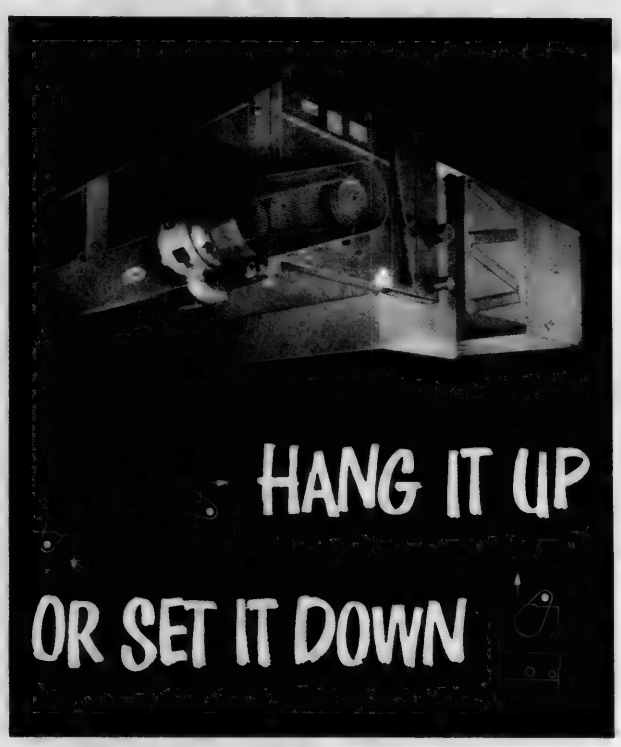
So Remember... item for item, every Sporlan product will give you Peak Performance... so why not get Peak Performance Right down the Line on ALL air conditioning applications... specify Sporlan throughout!

SPORLAN

SPORLAN VALVE COMPANY

7525 SUSSEX AVENUE ST. LOUIS 17, MO.

EXPORT DEPARTMENT 89 BROAD STREET NEW YORK 4, N. Y.



CARRIER HEATING AND VENTILATING UNITS

are almost "as versatile as a one-man band." They can be horizontally suspended, vertically suspended, or floor mounted . . . in schools, auditoriums, gymnasiums, garages, mills, factories and other large-area buildings.

Sectionalized construction affords ease of installation. Flexibility in selection and applications. Right- or left-hand assembly. Horizontal, upward or downward air discharge.

And that isn't all: Carrier Heating and Ventilating Units can be used with or without ductwork. Multiple discharge outlets permit air distribution where needed, under all conditions of full or partial loads. Air temperature is always under positive control.

Flat or V-type filter sections may be chosen. Mixing sections can be incorporated in a variety of arrangements. Heating coils are available in a wide selection—for steam or hot water. Face and by-pass dampers are interconnected for ready control of heated air and by-pass air.

Other features, inbuilt or optional, testify further to the ingenuity of Carrier engineering. To the quality of Carrier manufacture. And to the dependable performance of these widely acclaimed units. Capacities range from 1500 to 30,000 cfm.

For complete list of features and selection data, WRITE to Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

HPACCNA

(*Continued from page* 132)

members, about 14%, indicated that the total volume of business of the nationwide association, representing 40 local associations, approximates $1.25 billion. This figure is arrived at by projecting the returns to include the total membership.

Purchase of materials from manufacturers and suppliers, again projected, shows a total outlay of about $700 million for the year 1953. This represents an increase of nearly $75 million over the purchase figures reported for 1952.

• **HEATING PREFERENCES.**—As a result of interest shown in a 1953 survey of the heating preferences of architects and engineers for residential work in the Philadelphia area, the study was extended to eight other areas and reported at the 1954 meeting.

The eight areas surveyed were San Francisco, Kansas City, New England, New Jersey, Cleveland, Pittsburgh, and Houston. Replies to a questionnaire were tabulated with no attempt to draw conclusions from the data presented.

There were 623 replies to the question: If cost were not a factor, which heating system would you prefer? Steam and gravity warm air systems received a combined nod of 31 practitioners. Forced hot water was the preferred system of 357 respondents, while forced warm air received 269 votes. There were some regional differences reflected, for example, in a 71% preference for forced warm air in Houston and an 85% preference for forced hot water in New England and New Jersey.

For forced hot water systems, the preference in heating elements was 175 for panel heating, 138 for baseboard radiation, 78 for convector radiation, and six for free standing radiation.

Even distribution of heat was the reason most frequently checked supporting the choice of either air or water systems, while the second most frequent reason was better control for forced warm air and comfort for forced hot water. Cleanliness was also an important reason for choice of either system.

Gas was the outstanding choice for fuel, with 473 votes compared with 166 for oil and 9 for coal. Cleanliness was the principal reason for choice.

Present practice was reflected by response to a question phrased: Most of the homes I am designing and/or building are being heated with ———. Forced warm air led by a wide margin in homes of all sizes, accounting for 72% of small homes, 63% of medium homes, and 54% of large homes.

• T. T. Arden of Lynnwood, Calif., was elected president of the Gas Appliance Manufacturers Association at the trade group's recent 19th annual meeting held in Chicago. Mr. Arden is executive vice president of the Grayson Controls division of Robertshaw-Fulton Controls Co. Also elected to GAMA office were W. F. Rockwell, Jr., president of the Rockwell Manufacturing Co., Pittsburgh, first vice president; and A. B. Cameron, president of the Ruud Manufacturing Co., Pittsburgh, second vice president, Lyle C. Harvey, stays as treasurer.

For Strength and Stiffness Nothing Beats Galvanized Steel

Look at each of the materials commonly used for ductwork, and you realize the strongest and stiffest of them all is steel.

That's why a galvanized steel sheet has less tendency to buckle or kink in handling. Less bracing is needed. Longer unsupported sections can be used. And there is better resistance to damage from rough handling.

Bethlehem galvanized steel sheets are made from strong, durable steel, either plain or copper-bearing. Tight, uniform zinc coating guards them against corrosion. They are easy to cut, form, seam and solder. And they give a bright, clean look to any kind of sheet-metal job.

Bethlehem GALVANIZED Steel Sheets

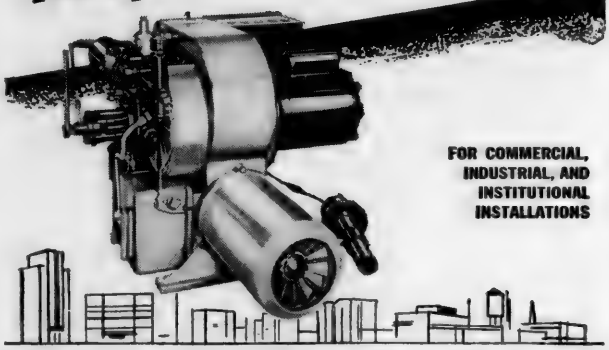
★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

Hev-E-Oil Burner keeps heat cheap!



FOR COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL INSTALLATIONS

Use heavy fuel oils *costing 30% less per gallon*

Cheap heat is smart economy! That's why thousands of owners are converting to Hev-E-Oil Burners and using *commercial* No. 4 or 5 heavy oils, costing 3 to 6¢ *less* per gallon than domestic light oils. Owners not only pocket the difference in cash, but get 7% more heat per gallon as well.

Hev-E-Oil Burners are specifically designed for heating buildings requiring more than 6,000 gallons of oil or 45 tons of coal per year.

Conversion is simple. The Hev-E-Oil fits all types of standard heating boilers and changeover takes only a few hours' time. Reports on file show fuel savings pay for conversion in a season or two.

QUICK FACTS ON HEV-E-OIL BURNER

- Automatic, all-electric ignition
- Flame size set exactly to furnace capacity
- Low-pressure, air-atomizing, with large, non-clogging nozzle
- Six sizes: 1 to 60 gph
- Built-in low fire start
- As simple to install as a domestic burner
- Easy servicing and cleaning
- Air and oil metered to give high efficiency

If you own, specify, install or service burners, get all the facts about Hev-E-Oil Burner — a *quality* product of America's leading manufacturer of self-contained boilers and oil-fired equipment. Write for illustrated Bulletin AD-102 NOW. CLEAVER-BROOKS COMPANY, Dept. H, 382 E. Keefe Ave., Milwaukee, Wis.

Sales and Service In Principal Cities

Cleaver Brooks

HEV-E-OIL BURNERS ARE DESIGNED TO SAVE YOU MONEY

ASRE

to hold 41st semi-annual meeting in Seattle with conferences and papers on domestic railway and commercial cooling.

A balanced program of technical and social activity is offered by the American Society of Refrigerating Engineers in the announcement of their 41st Semi-Annual Meeting to be held July 11-14 at the Olympic Hotel, Seattle, Washington. An innovation in the program for Seattle is a series of four forums, or seminars, at which discussions will be held on: (a) Oil problems with Freon 22, (b) capillary tubes versus expansion valves on commercial self-contained air conditioners, (c) refrigeration problems in the meat packing industry and (d) new thinking on short form air conditioning load calculations. These forums will consist of strictly informal, non-recorded, round-table discussions with no holds barred. It is anticipated that suggestions for research projects and subjects for future technical papers will result from these forums.

• **CONFERENCES.**—Conferences on particular phases of domestic refrigerator engineering and air conditioning will be held, as usual, running concurrently with the technical sessions on Monday and Tuesday mornings, July 12 and 13, respectively.

The refrigerator engineering conference will analyze trends affecting domestic refrigeration and the air conditioning conference will be devoted to the subject of room air conditioners with particular emphasis on the part played by the public utilities.

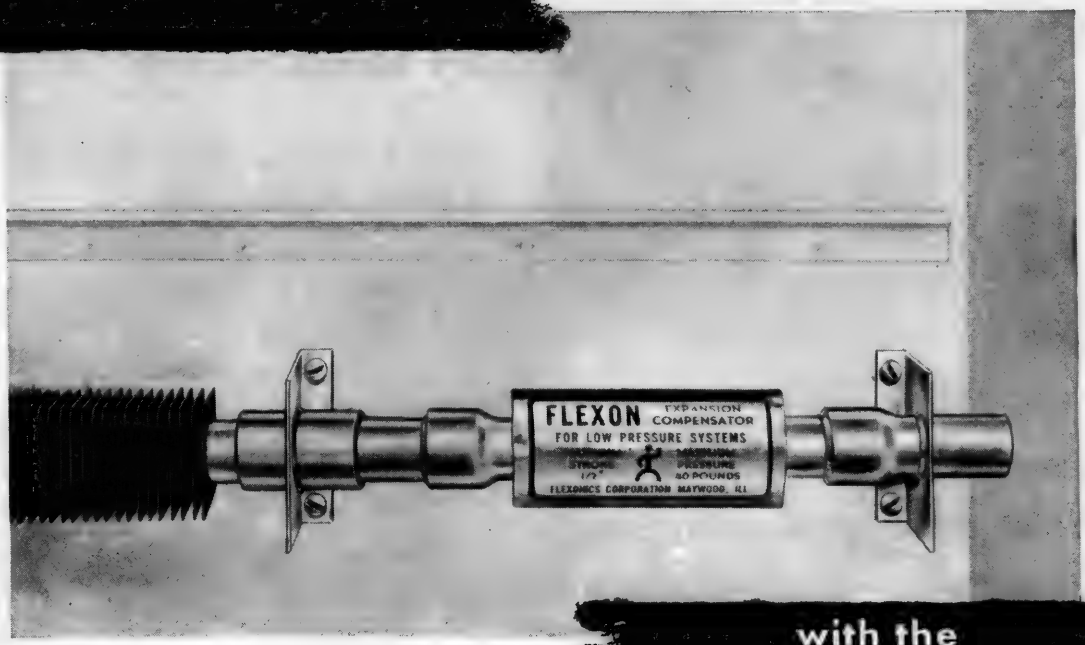
• **PAPERS.**—Technical sessions will be held on Monday, Tuesday and Wednesday mornings at which will be presented eleven papers and a motion picture film. This color film will illustrate the application of insulation to a cold storage warehouse by the precast tilt-up method.

At the Monday morning session there is scheduled a discussion of the relative merits of mechanical versus the ice systems for maintaining storage temperatures in railroad refrigerator cars. The Tuesday morning session will be devoted to the subject of measuring the conductivity of commercial insulation. Three papers will be presented dealing with the use of conventional instruments in the laboratory; the heat flow meter in the laboratory and on the job; and a vapor barrier of zero permeability with flexible strength consisting of a laminate of polyester film and aluminum. The final technical session on Wednesday morning will offer a variety of papers such as: An explanation of how an unlimited supply of fresh water can be obtained by freezing salt water and the limitations of the process; new charts and tabulations that simplify the determination of pressure drop through the evaporator circuit, suction, discharge and liquid lines for Freon 12 and 22 in standard sizes of copper tubing.

• *Correction:* The uranium refinery described on page 142 of the June issue as a $2 million establishment was actually constructed at a cost of about $78 million. The cost of heating, ventilating, and dust control equipment approximated $2 million erected.

STOP

expansion leakage and pipe creeping noises in steam and hot water heating systems



with the NEW FLEXON EXPANSION COMPENSATOR

DESIGN DETAILS

The Flexon Expansion Compensator consists of a two ply phosphor bronze bellows with copper tube end connections (sizes ¾" to 1¼") enclosed in a floating protective shroud of brass. All joints are electronically sealed with silver solder for long leak-proof life. The 2" size has standard threaded fittings. Threaded fittings for other sizes are also available. A single compensator will handle total piping motion up to ⅝" (½" in compression, ⅛" in extension). Suitable for temperatures from —60° F. to 250° F. and for pressures up to 40 psig.

Now, for the first time, there is a practical, economical answer to the problem of expansion control in low pressure steam and hot water heating systems—the new FLEXON Expansion Compensator. It is especially designed and manufactured for finned type convectors, baseboard, radiator or heating supply lines. The FLEXON Expansion Compensator absorbs thermal expansion and puts an end to the danger of leakage that often results from the stresses set up by uncontrolled expansion. At the same time it eliminates the pipe creeping noises that frequently accompany expansion. Important, too, is the fact that FLEXON Expansion Compensators are made to outlast the building in which they are installed. There is no maintenance . . . just put them in and forget them.

FLEXON Expansion Compensators are made in ¾", 1", 1¼" and 2" sizes. Contact your local distributor for further information, or use the coupon below to get the descriptive bulletin.

Flexonics Corporation

Flexon identifies products of Flexonics Corporation that have served industry for over 52 years.

EXPANSION JOINT DIVISION
1326 S. Third Avenue
Maywood, Illinois

Flexonics Corporation
1326 S. Third Ave.
Maywood, Ill.

Please send me the bulletin which describes and gives full specifications for the Flexon Expansion Compensator.

Name .....

Company .....

Address .....

City ..... Zone .... State .....

My Wholesaler is: .....

Saves 75% of fastening time by anchoring sheet steel wall with fast, easy *Ramset* system

About 20,000 individual fastenings were needed to anchor 4′ x 8′ 12-gauge perforated steel sheets to steel beams, to wall the paint hangar at the recently completed airplane plant of North American Aviation Corporation, Columbus, Ohio. The wall is required to permit adequate ventilation of 47,250 square feet of space, with a change of air every three minutes from air intakes and exhausts located on opposite sides.

Using RAMSET JOBMASTER fastening tools and Tru-Set drive pins, fastenings were made at a rate better than 50 per hour per man, or 1,200 per day for a three-man crew. This was at least 4 times faster than old-fashioned, conventional methods of drilling and setting studs in the beams. Not only was the work completed far sooner, but a substantial cost-reduction was realized.

Similarly, RAMSET SYSTEM saves money and time on almost any job of fastening to steel or concrete for maintenance, modernization or new construction. Anchoring can be done in split seconds into the hardest concrete, or into mild steel up to 1″ thick, with the proper selection of tools, fasteners and power charges from the versatile RAMSET line.

Ask your RAMSET dealer how you can profitably apply RAMSET SYSTEM to your own work, or write us for details and *Specification Manual*.

Ramset Fasteners, INC. RAMSET DIVISION, OLIN INDUSTRIES, INC.

12135 BEREA ROAD • CLEVELAND 11, OHIO

FIRST IN POWDER ACTUATED FASTENING — AN Olin PRODUCT

PIPING AND PLUMBING

(*Concluded from page 99*)

Size of gas meter.....Location.....
Condition of piping .....
Local gas company.
(a) Name .....
(b) Telephone No. .....
(c) Obtain their requirements .....
Are present mains and risers of sufficient size for new work? .....

Plumbing Fixtures

If plumbing fixtures are to be relocated and reused, or if the new fixtures must match existing one, obtain the following:
(a) Water closets .....type.....trim.....
(b) Urinals .....type.....trim.....
(c) Lavatories .....type.....trim.....
(d) Drinking fountains .....type.....trim.....
(e) Other fixtures .....

Cafeteria Equipment

If new work is required—
(a) Condition of present equipment .....
(b) Which fixtures have 180F hot water .....
(1) How is it furnished .....
(2) Location of heater.....size.....
(c) Present grease interceptors—
(1) Manufacturer .....
(2) Size .....
(3) Location .....
Is present piping of sufficient size for new work? .....

Miscellaneous Piping and Equipment

Use this space for any piping, equipment or special conditions not covered .....
Date .....
Survey made by .....

Canadian Degree-Days for May, 1954*

City	May		Cumulative	
	1954	Normal	1954	Normal
Calgary, Alta.	558	480	10296	9111
Charlottetown, P.E.I.	558	536	7615	8263
Crescent Valley, B. C.	369	403	7345	7731
Edmonton, Alta.	513	428	9741	9797
Fort William, Ont.	705	567	9930	10045
Grand Prairie, Alta.	527	505	10930	10122
Halifax, N. S.	506	493	6514	7395
London, Ont.	415	307	6937	7275
Medicine Hat, Alta.	375	301	8499	8495
Moncton N. B.	555	474	7827	8568
Montreal, P. Q.	350	325	7663	8413
North Bay, Ont.	515	434	8994	9180
Ottawa, Ont.	350	310	7980	8674
Penticton, B. C.	295	273	6164	6346
Porquis Junction, Ont.	583	558	10590	11144
Prince George, B. C.	508	490	9136	8996
Quebec City, P. Q.	468	428	8446	9276
Regina, Sask.	558	434	9918	10891
St. John, N. B.	524	505	7636	8081
Saskatoon, Sask.	527	397	10343	10478
Toronto, Ont.	331	341	6336	7236
Vancouver, B. C.	328	326	5242	5303
Victoria, B. C.	378	366	5050	4935
Windsor Ont.	346	251	6063	6705
Winnipeg, Man.	558	397	10014	10841

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

BARBER COLMAN

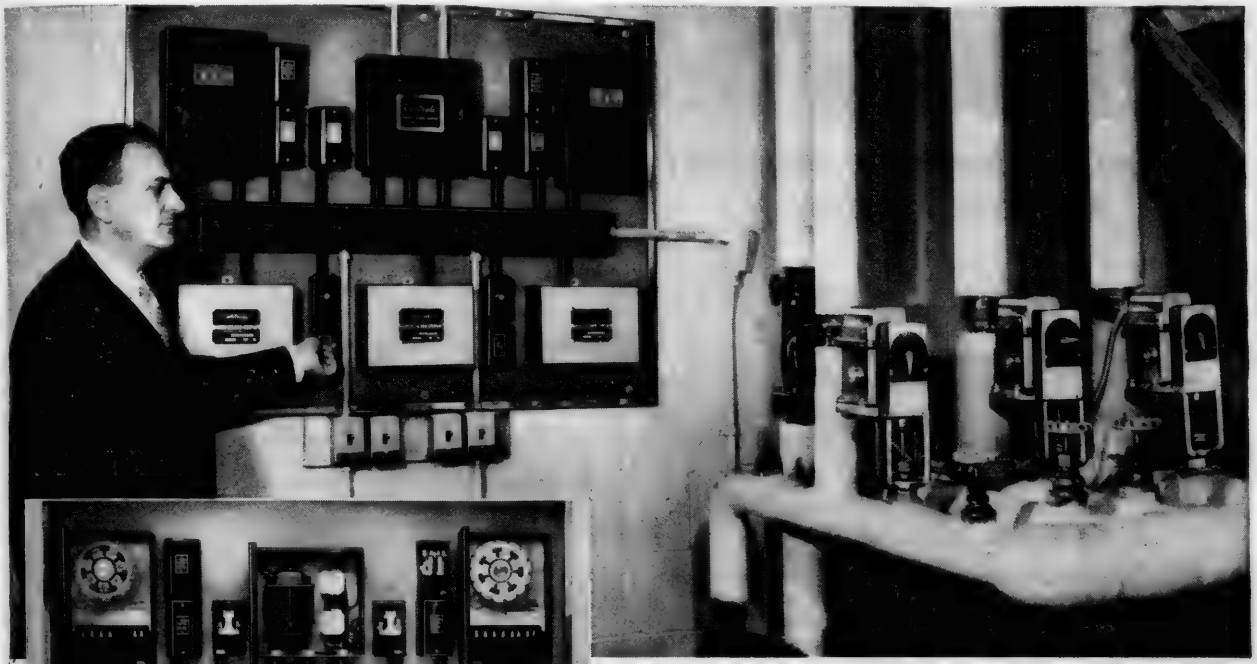
ELECTRIC

Control Center

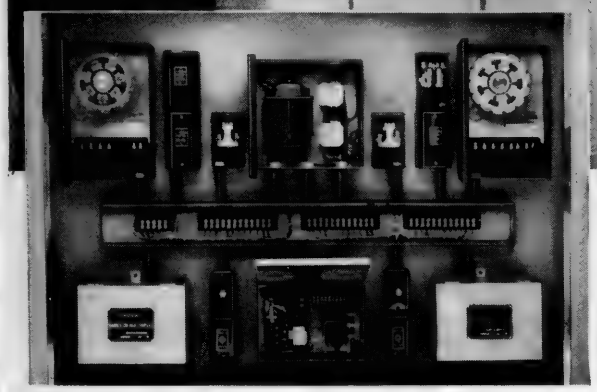
...modern way to control heat in elementary schools

Today progressive engineers are standardizing on simplified, all-electric systems which provide newest features for accurate control at lower cost. For example, Marcus R. Durlach, Jr. has specified the Barber-Colman "Control Center" system for schools throughout the Southeast. In spite of rapid and wide variations of outdoor temperature in that region, the streamlined, modern control system provides even, comfortable heat throughout each building. Not only is the finished job more attractive and effective, but money is saved in purchasing equipment, installation, servicing, supervision, and operation.

(left): Swansea Elementary and High School, Swansea, South Carolina. *Architect:* Jesse W. Wessinger, AIA, West Columbia. *Engineer:* Marcus R. Durlach, Jr., Columbia. *Heating Contractor:* W. B. Guimarin Company, Columbia.



"Control Center" panelboard integrates components and accessories for heating system, serves as central junction point for wiring and adjustments. Three Proportioning Motor-Operated Valves at right are controlled by Adjustable Ratio Outdoor Reset Controls mounted at bottom of panelboard.



"Control Center" panelboard as it arrives on the job . . . prewired and prechecked, ready for swift, error-free connection.

Radiant floor panels, unit heaters, and finned pipe radiation are combined in the four-zone system to provide most effective heating of each area in the Swansea School. Temperature is lowered evenings and week ends by Seven-Day Time Clocks with manual override switches. Adjustable Ratio Outdoor Reset Controls position the Motor-Operated Valves, increasing or decreasing heat flow as dictated by outdoor temperatures. Every modern control feature is incorporated here, yet this simplified automatic electric system costs less to own, operate, and maintain than conventional systems. For complete information, phone your nearby Field Office, or write us.

In Cafeteria, Barber-Colman Room Thermostat (left) and Strap-on Thermostat (center) control operation of cabinet-type heater.

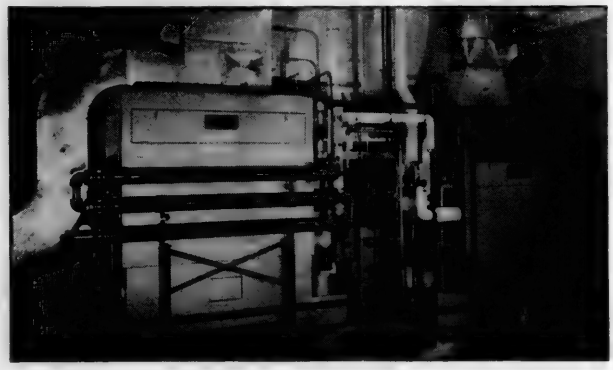
BARBER-COLMAN COMPANY

Dept. G., 1302 Rock Street, ROCKFORD, ILL., U.S.A. • Field offices in principal cities

Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HV **405 Lexington Ave. New York 17, N. Y.**

Sales Engineers in Principal Cities of U. S. and Canada

ABSTRACTS AND REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

HEAT CONDUCTION

The present book Heat Conduction With Engineering, Geological, and Other Applications, by Leonard R. Ingersoll, emeritus professor of physics, University of Wisconsin; Otto J. Zobel, formerly with the technical staff, Bell Telephone Laboratories, Inc.; and Alfred C. Ingersoll, assistant professor of civil engineering, California Institute of Technology, is really a third edition.

The major changes in this volume as compared to previous editions are the additions which have increased the book content by twenty percent. A chapter has been added for the heat pump since the use of the ground as a source of heat involves a number of phases of heat conduction theory. Material is also included on drying and soil consolidation, both fields of increasing importance.

Some of the chapters included in the book are: The Fourier conduction equation; steady state—one dimension; steady state—more than one dimension; periodic flow of heat in one dimension; Fourier series; linear flow of heat; flow of heat in more than one dimension; formation of ice; auxiliary methods of treating heat conduction problems; methods of measuring thermal conductivity constants; theory of earth heat exchangers for the heat pump; drying and soil consolidation. A large number of tables are included in the appendix section of the book.

Heat Conduction With Engineering, Geological and Other Applications, by L. R. Ingersoll, O. J. Zobel and A. C. Ingersoll. Cloth bound, 6 x 9 inches, 325 pages. Published by The University of Wisconsin Press, 811 State St., Madison, Wis. Price $5.

• • •

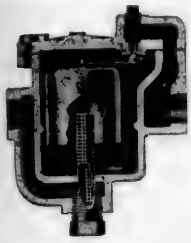
ARI STANDARDS—Thirty-one individual standards covera wide range of air conditioning and refrigeration products are presented in the first set of standards to be issued by the Air-Conditioning and Refrigeration Institute. Included is tentative Standard 6-10 on Application Engineering Standard for Year-Round Residential Air Conditioning which contains the Institute's recommendations for calculating residential cooling loads. While the newly published standards are the first to bear the ARI name, most of the standards are revised editions of standards issued previously by ACRMA and REMA. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Avenue, N.W., Washington, D. C. Price for complete set, $5, although specific standards are sold separately. Write to the association for prices.

NEW YORK STATE BUILDING CONSTRUCTION CODE—Recently published is the New York State Building Construction Code Applicable to Multiple Buildings. The purpose of this code is to establish reasonable safeguards for the safety, health and welfare of the occupants and users of buildings. Municipalities of the state have the

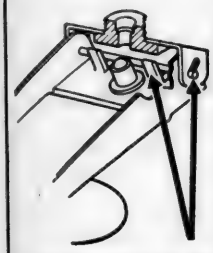
(*Concluded on page* 142)

NEW TRAP

handles more volume in less time!



Sarco *Camlitt* Bucket Trap



Cams lever valve off seat; slot and pin provide maximum valve opening

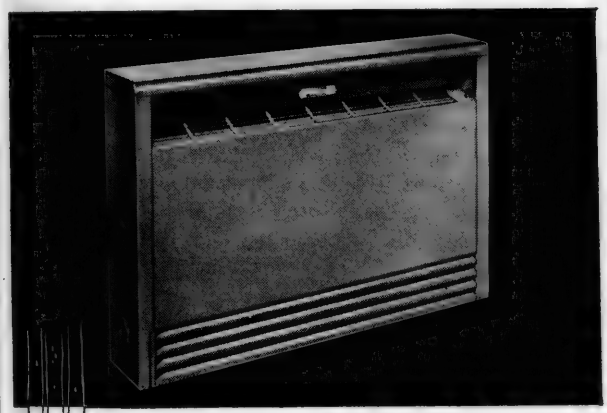
Sarco uses the principle of the fulcrum and lever in this newly designed trap and gives you greater discharge at no increase in trap size. Result: more for your steam trap dollar.

It's all made possible by the Sarco *Camlitt* valve mechanism which provides the force needed to open the large valve without a corresponding increase in trap size.

See for yourself how this small inverted bucket trap gives you maximum capacity.

Write for free trial trap giving pipe size, capacity, and pressure conditions.

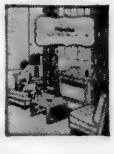
SARCO COMPANY, INC.
EMPIRE STATE BUILDING, N. Y. 1, N. Y.



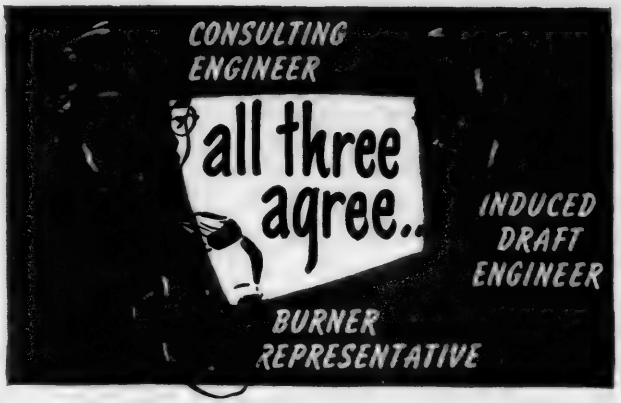
Superb styling . . .
Superb performance

R-1232

WHEN top architects and heating engineers want the finest in modern heating, they specify Modine Convector Radiation. Here's an unmatched combination of beauty, long life and uniform, healthful heating. Ask your Modine representative for full information — he's listed in the classified section of your phone book. Or write for Bulletin SA-54, Modine Mfg. Co., 1511 DeKoven Ave., Racine, Wis.



Modine
convector radiation



INDUCED DRAFT SYSTEMS *need* SELECTED STARTING DRAFT!

A Draft Inducer is designed to provide a constant draft supply for maximum stack requirements. Without proper controls, it delivers maximum draft at all times. But under some conditions, this maximum draft needs correction—in particular during initial light off, whether on low-fire start, "high-low" burners or modulating burners, where excessive draft often causes starting failure or re-cycling.

CLEVELAND DAMPER CONTROL

***provides the* 4 CONTROL FEATURES *essential to safe efficient operation of* INDUCED DRAFT SYSTEMS**

1. **STARTING DRAFT SELECTOR**—providing pre-determined optimum draft for smooth, safe, ignition. When ignition is completed, damper control goes to full, automatic draft regulation.
2. **AUTOMATIC DRAFT MODULATION**—maintaining ideal draft for proper combustion under varying firing rates and stack conditions.
3. **AUTOMATIC SEQUENCE OPERATION**—providing proper draft for all phases of firing cycle, with proper shut-off of draft during "off" periods.
4. **LOW DRAFT CUT-OFF**—providing the safety of an integral minimum draft switch that shuts down firing at unsafe low draft limits. Time-delay feature prevents nuisance shut-downs due to momentary puffs.

Only CLEVELAND DAMPER CONTROL can give ALL 4!

Write for complete information.

The CFE line includes damper controls, steam controls, electronic smoke detector control units, draft, air pressure and flue temperature gages.

COMBUSTION INSTRUMENTS & CONTROLS FOR EFFICIENCY AND ECONOMY
CLEVELAND FUEL EQUIPMENT CO.

CLEVELAND FUEL EQUIPMENT COMPANY
1111 BROOKPARK RD. • CLEVELAND 9, OHIO

(*Concluded from page* 140)

option to accept or not to accept the applicability of the state building construction code. State Building Code Commission, 1740 Broadway, New York 19, N. Y.

BITUMINOUS COAL ANNUAL—A volume of facts and figures regarding the production of bituminous coal through 1952 is contained in this paper bound book, which is well illustrated with graphs and photographs. It contains a series of frequently asked questions and their answers, a glossary of mining terms, and an appendix devoted to a wage chronology. This book of facts and figures is the sixth of a series that was first started in 1948. Bituminous Coal Institute, Southern Building, Washington 5, D. C.

LONDON LETTER

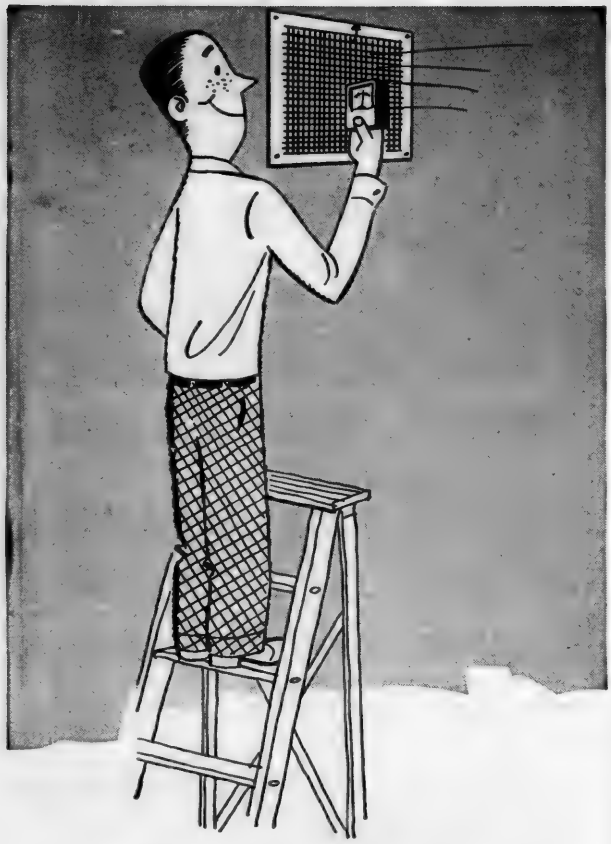
(*Concluded from page* 118)

achieved by means of a wooden "muff" and a plantation of lime trees.

In Paris the "Sheep-jumps" where the outer circular road crosses under the main radial arteries would in most cases fail of their purpose were they not straight. A photo-electric cell measures the daylight and adjusts the intensity of the lighting inside. The lights are in niches 9 ft above the road. From the Arc de Triomphe we followed the route of the Airline Coaches to Le Bourget Airport, and dived under Porte Clichy and Porte de Clignancourt before continuing our northward progress to the Channel. Artificial ventilation has been provided for these "Sautes-de-mouton", but has not been found necessary.

The 40,000 yard long Channel Tunnel was to be the triumph of the ventilating engineer's art. We knew it had been proposed to work the fans in relays, a fan at each end pumping 50% of the required air for 2,000 yards, a second to send 45% on a further 3,000 yards, a third to handle 37½% and push it 5,000 yards, and a fourth to take 25% and pass some of this the remaining 10,000 yards to the center. Even if it had been decided to use oxygen or ozone to counteract the CO, this would result in minimum fan power. But when we got there we found we were not allowed to drive through at all. Our auto was picked up on a fork lift and piggybacked through to England. The electric power needed for this was less than for ventilating at a rate to deal with CO. Besides, there was a further problem: this tunnel has a steady year-round temperature of 45 to 50°F, and it struck chill as we left summer above. De-humidifying all that air would have been too large an undertaking. Yes, it was really very cold . . .

The reason for this was, as your Correspondent found when he woke up, that the shadow of the apple-tree now fell across his chair. Although there is a Channel Tunnel Co. looking after the shafts sunk years ago, the Mont Blanc and the Channel tunnels are still only pipe dreams. Furthermore that pony died years before the Mersey Tunnel was finished, and your Correspondent doesn't posses an automobile. But there on the grass beside him were the April and May issues of Vol. 29 of *Chauffage, Ventilation, Conditionnement* with five papers presented at a Paris conference on road tunnels. This of course explains everything, except the photographs.



Balancing Air Supply a Problem?

. . . then you need the fast, accurate air velocity readings you get with an Alnor Velometer Jr. This palm-size instrument takes the expensive guesswork out of balancing systems and speeds up adjustment of any air conditioning, heating, and–or ventilating set-up.

The Velometer Jr. is a miniature, direct-reading air-velocity meter that's precision built for lasting accuracy. It has double-pivoted, double-jeweled movement, air-actuated pointer vane, and sturdy molded Bakelite case. Available with single or double velocity range scales, Velometer Jr. can be one of your most useful tools for years to come. Send today for complete details. Illinois Testing Laboratories, Inc., Rm. 514, 420 N. La Salle Street, Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

HEATING AND VENTILATING'S *Ad-Digest* SERVICE

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all advertisements, those which are received after the published closing date may not appear. The Index of Advertisers lists all the advertisements in this issue.

CORROSION CONTROL. Page 153. A chemical in tablet or granular form which can be used while plant is in operation. Removes rust, scale, and algae or other encrusting matter from condenser tubes and compression jackets in 1 to 5 hours. A safe, economical method for controlling corrosion or scale. .....Item 201

REVOLVING UNIT HEATERS. Page 53. The slowly revolving outlets of this line of unit heaters keep air in constant motion whether it be heated air in winter or cooling air in summer. Literature available. .....Item 202

PROJECTOR FANS. Page 1. A line of projector fans of high capacity and shaped outlet capable of shooting air distance of 60 feet without ducts at velocities up to 5,780 fpm. Fan is a 14-blade axial flow pressure fan built into a nozzle shape housing. Suitable for cooling workmen or equipment. Furnished with wall-mounting brackets or on wheeled stands. In diameters from 18 to 30 inches. Bulletin available. .....Item 203

HEATING SPECIALTIES. Page 14. Three Chicago suburbs have equipped new schools with this line of valves and traps in steam heating systems. Packless radiator valves and radiator traps went into the heating systems, which involved both direct and indirect radiation. Catalog available. .....Item 204

COOLING TOWERS. Page 125. How pressure creosoting adds years of life to this company's towers. Constantly wetted wood decking in a cooling tower is subject to attack by fungus and marine parasites. Wood used in this company's towers is protected against these enemies. .....Item 205

VENTILATING SYSTEMS. Page 153. Each ventilating job presents problems that can be solved by a company having a comprehensive line, such as this one which makes axial flow fans, roof penthouse units, attic fans, duct boosters and other equipment. Data sheets available. .....Item 206

AIR CONDITIONING UNITS. Page 22. A line of air conditioning units for remote applications for multi-room installation and for larger buildings where hot water is piped to the units in the winter and chilled water in the summer. Units are available in 200, 400 and 600 cfm capacities. Bulletin available. .....Item 207

BALANCING VALVES. Page 21. These valves give accurate control of water flow and positive shut-off for air elimination in connection with radiant hot water heat. Made with flared fittings for ⅜- and ½-inch tubing. A line of manifolds with or without the balancing valve is available. .....Item 208

HEATING CONTROL. Page 41. A single-dial system for controlling heat in accordance with weather conditions offers ease of installation to the contractor and convenient economy to the user. 16-page bulletin available. .....Item 209

AIR CONDITIONING UNITS. Page 30. Air conditioning units with five outstanding features, including muggy air control, blow-through design, anti-sweat construction, quiet operation and graceful lines. Bulletin available. .....Item 210

FLEXIBLE HOSE. Page 150. A line of flexible spiral-wire reinforced hose in sizes from 1¼ to 36 inches for handling air, dust, gases, materials and available with accessories in a variety of coatings. Catalog. .....Item 211

COMPRESSORS. Page 25. Hermetically sealed, welded motor compressors in an engineered package combine a twin-cylinder quiet operating compressor with heavy-duty motor for F-12 refrigeration systems. Manufacturers invited to try unit in equipment. .....Item 212

ROTARY VENTILATORS. Page 150. Where the problem is ventilation, the solution is a rotary ventilator with or without fans. A two-mile per hour wind operates the unit and it continues to exhaust during wind lulls due to balanced design. Catalog available. .....Item 213

MOTORS. Page 152. Thousands of unit heaters, electric hoists, hydraulic pumps, exhaust fans, oil burners, and other equipment receive dependable power from this line of motors which is available in sizes from 1/30 to 5 hp. Bulletin. .....Item 214

EXPANSION JOINTS. Page 25. These expansion joints are packed with a gun and will operate smoothly as frequently as required over long full-traverse up to 12 inches for the single type or 24 inches for the double type, day in day out with no danger of metal fatigue or failure. They can be serviced under full steam pressure. Bulletin available. .....Item 215

POWDER POWER TOOL. Page 45. A fast acting system of drive pins and explosive cartridge action for fastening duct work to steel or concrete features an exclusive break-open action of the holding tool and a single standard powder charge regardless of penetration desired. Cannot be discharged accidentally. Air conditioning ducts installed in a Miami hotel in record time with this tool. Literature available. .....Item 216

AIR DIFFUSERS. Page 54. Square diffusers, such as those installed in the Alcoa Building in Pittsburgh and other buildings calling for efficient performance and attractive appearance with rigid engineering and architectural specifications. ..Item 217

COPPER WATER TUBE. Page 111. Radiant panel heating fits perfectly into the growing trend to one-story school construction and the ideal material for panel heating is copper. Use of this copper water tube means easy bending and handling, its long lengths require fewer fittings, and the solder fittings used eliminate need for welding, wrench work, and thread cutting. Technical advisory service available. .....Item 218

PLEASE SEND US MORE INFORMATION

Enter below item numbers on which you wish further information.

Item No.....	Item No.....	Item No.....	Item No.....	Item No.....
Item No.....	Item No.....	Item No.....	Item No.....	

Enter numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE PRINT July AD-54

Name ..... Title .....

Firm .....

Nature of Firm's Business .....

Street .....

City ..... Zone..... State.....

This card is void after Oct. 1, 1954

Ad-Digest SERVICE

VALVES. Page 32. The Lever House in New York, which made extensive use of glass which permits direct penetration of sun heat, and in which interior comfort is dependent on efficient year-round air conditioning, guards against the serious consequences of failures and interruption of the air conditioning facilities to offset this by selection of this company's valves after a thorough study of performance records in all types of service. ...Item 219

FREON COMPRESSOR. Page 28. Years were spent in developing this new Freon compressor of which the features include the trim, sturdy construction, easy removal of gas strainer in the suction line, operating efficiency, and high capacity. Information available. .....Item 220

AIR DRYING. Page 140. Controlled humidity air conditioning by this method which removes moisture from air by contact with a liquid in a small spray chamber. The spray contact temperature and the absorbent concentration factors easily and positively controlled, determine exactly amount of moisture remaining in leaving air. Information available. .....Item 221

EXTENDED SURFACE. Page 126. Extended surface heat exchange equipment for heating, cooling, process and air conditioning. Your local representative's recommendation means high efficiency, long service life, and low maintenance costs. .....Item 222

TEMPERATURE REGULATORS. Page 60. These regulators are guaranteed to shut tight when the demand for steam ceases. Expensive steam leaks due to a lack of tight shut off are eliminated. Bulletin available. .....Item 223

AIR TURNING VANES. Page 145. The original job-tested rail, a fast, accurate and inexpensive way of making air turning vanes with installed cost cut 50% to 70%. Eliminates layout and is supplied in 8-foot lengths. Manual available....Item 224

DUCT CONNECTOR. Page 144. A one piece fabric and metal duct connector preassembled makes quality flexible ducts up to 70% faster than older methods. Wide metal edges are ample to form all types of joints. Stops vibration noise in furnaces, blowers, air conditioners or attic fans. Stapler eliminates costly sewing of fabric. Available in canvas, asbestos or neoprened fiberglass. Literature available. .....Item 225

PIPING. Page 143. A special fabricating service to save time, material and labor in piping systems. Numerous flanged joints are eliminated and several fittings combin into one. All types of materials can be so fabricated in sizes from 3 to 44 inches in diameter. Bulletin available. ...Item 226

MOTEL CONDITIONING. Page 46. From a central station comes chilled water for cooling and warm water for heating at a large motel in Miami Beach. The water, cold or hot, according to the season, is piped to overhead air conditioning units in each apartment. Each apartment also has individual room control. .....Item 227

DAMPER CONTROL. Page 141. This damper control provides four control features essential to efficient operation of induced draft systems. System includes starting draft collector, automatic draft modulation, automatic sequence operation and low draft cut-off. Information available. .....Item 228

HEATING & VENTILATING UNITS. Page 33. These units are custom assembled from standard components and include a wide choice of fan sections, many radiator types and capacities, humidifier if desired, choice of filter sections and mixing damper section if desired. Catalog available. .....Item 229

PIPING SYSTEM. Page 42. This company's prefabricated insulated piping systems feature advance design, with positive security, outstanding economy, and quality for underground and overhead distribution of steam, condensate return, hot and chilled water. Additional information available. .....Item 230

FLUSH VALVES. Page 9. The interior working assembly of this flush valve comprises only six component parts, a maintenance advantage obtained only in a diaphragm type valve. Handbook available. .....Item 231

SMALL MOTORS, BLOWERS. Page 147. Fifty-million of this company's small motors have been in use for the last 25 years. They offer the manufacturer the latests developments in electric motor design and are available in a wide selection of sizes from 1/500 to 1/6 hp and blowers from 50 to 280 cfm. .....Item 232

COAL BURNING. Page 115. In most places coal is today's lowest cost fuel. Advertisement features a distilling company's modernized power plant with three boilers now providing more steam than six boilers did before modernization. Increased efficiency has resulted in large fuel savings, smokeless operation and reduced maintenance cost. .....Item 233

STEAM COILS. Page 151. These standard steam heating coils assure maximum heat transfer. They have heavy aluminum fins and heavy galvanized steel casings. Extruded fin collars entirely surround copper tube. Steam idstributing tube heating coils are also available. Catalog available. .....Item 234

EVAPORATOR PRESSURE REGULATOR. Page 43. They keep your coolers from bursting and prevent freeze-up with this company's evaporator pressure regulators which hold evaporator pressures up to predetermined point when the load changes. Available for any size water cooler from drinking fountains to large industrial installations. .....Item 235

PUMPS. Page 61. If you're interested in reducing installation and maintenance cost don't overlook this line of dependable pumps which include vacuum pumps, condensate pumps, turbine pumps, and vertical pumps. They are built compactly and are easily installed whether for below floor level returns or in cramped quarters. .....Item 236

MULTI-ROOM AIR CONDITIONING. Page 39. A line of room air conditioners for multi-room buildings and available in 4 types in 3 different sizes, 200, 400 and 600 cfm. These include a hideaway type, ceiling type, and recessed installation type for mounting. There is also a floor type for free standing along walls or beneath windows. Bulletin available. .....Item 237

UNIT HEATERS. Pages 12-13. Announcing a new line of vertical unit heaters for ceiling to floor heating and available in sizes from 58,400 to 560,000 Btu per hour and a new line of horizontal unit heaters in sizes with capacities from 18,000 to 357,500 Btu per hour. The horizontal heater is truly quiet, the vertical heater has heat flow control. Casing is constructed of heavy-gage furniture steel, horizontal heater has serpentine coils specially designed for hot water systems.....Item 238

EXPANSION JOINTS. Page 137. Stop expansion leakage and pipe creeping noises in steam and hot water heating systems with this expansion compensator available in sizes from ¾ to 1¼ inches. It is especially designed and manufactured for fin type convectors, baseboard radiator or heating supply lines. There is no maintenance. Bulletin available. .....Item 239

HEAVY OIL BURNERS. Page 126. Use heavy fuel oils which cost 30% less per gallon. These oil burners use commercial No. 4 or No. 5 heavy oils and are especially designed for heating buildings requiring more than 6,000 gallons of oil or 45 tons of coal per year. Conversion is simple. Comprehensive bulletin available. .....Item 240

PACKAGED STEAM PLANTS. Page 57. Forced draft industrial oil burners combined with the company's packaged Scotch marine type boiler engineered specifically for use with this unit or the burners can be used to convert any old or new boiler. Information on how to specify is included. Ask for detailed information. .....Item 241

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING

148 LAFAYETTE STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

Use this Digest to locate and refer to advertisements appearing in this issue of HEATING AND VENTILATING, then fill out and mail the prepaid postcard to request further information.

COOLING TOWERS. Page 35. This line of cooling towers offers an efficient, economical unit for every possible installation. New units for 1954 comprise a counterflow steel series for 250 tons capacity and upwards, a double flow unit which adapts the most popular intermediate capacity cooling tower to larger capacity services, and a third tower in a packaged type which now includes capacities from 2 to 60 ton range. Information available. ----------Item 242

PACKAGED BOILER. Page 10. A consulting engineering firm conducted a test on a 150 hp boiler of this type firing Bunker C fuel oil and obtained steam quality of 99.77% and a boiler efficiency of 84.08% at full load. Boilers available in sizes from 20 to 500 hp. Bulletins available. ----------Item 243

SNOW MELTING. Page 34. The advantages of snow melting systems in industrial and commercial applications are described in this advertisement which offers a free 32-page color booklet entitled Steel Pipe Snow Melting and Ice Removal Systems. ----------Item 244

BOILER LEVEL CONTROL. Page 147. A boiler water level control with unlimited operating life and which operates by magnetic force. The actuating magnet is rated at 98% of initial strength after 30 years of service. Available in single or multi-stage models for all boiler water applications. Catalog available. ----------Item 245

PERIMETER HEATING. Page 2. How a bank has paired complete air conditioning with a hot water perimeter heating system to obtain winter-long comfort. The floor type convectors are tucked beneath the large window areas and and along all exposed walls around the perimeter of the building. ----------Item 246

FREON COOLERS. Page 127. How this company's dry expansion Freon coolers are used in the world's largest variety store in Brooklyn. Four of the coolers, 3 in a sub-basement and 1 on the second floor provide a total capacity of 350 tons of refrigeration. Catalog available. ----------Item 247

SHUTTERS. Page 152. A ventilating shutter with many advantages including weather-stripped louvers and louver blades with felt silencing pads. Available from 12 to 72 inches square and also rectangular shapes. Catalog available. ----------Item 248

RESIDENTIAL AIR CONDITIONER. Page 49. A unit designed to fit furnace blower capacity and make year-round home air conditioning a practical and economical reality. Shipped as a complete packaged unit with full hermetic compressor, aluminum fin evaporator, and cleanable type condensor. Available in 2, 3 and 5 ton sizes. Details available. ----------Item 249

FAN COOLING FANS. Page 145. These fans, intended for spot cooling of men and machines, drying, exhausting and general ventilating, are available in pedestal, cradle and wheeled models. Adjustable for 180 degree directional air discharge. A wide range of sizes. Folder available. ----------Item 250

HEATING AND VENTILATING UNITS. Page 134. These units can be horizontally suspended, vertically suspended, or floor mounted in schools, auditoriums, gymnasiums, garages, mills or factories. Sectionalized construction affords ease of installation, flexibility in selection and applications. Available in right- or left-hand assembly. Capacities range from 1,500 to 30,000 cfm. ----------Item 251

HEAT TRANSFER EQUIPMENT. Page 129. This line includes evaporative condensers and cooling towers, air conditioning blower units in 13 sizes, direct expansion Freon coolers as well as coils, air conditioning units, heating and ventilating units, sprayed coil dehumidifiers. Information available. ----------Item 252

STEEL BOILERS. Page 54. Two of this company's boilers are in the latest link in the Federal department store chain and equipped with jet action circulation which increases the speed at which steam and hot water leave the water leg. Item 253

AIR VELOCITY METER. Page 142. If you have a problem of balancing air supply then you need the fast, accurate air velocity readings you get with this instrument which is direct reading and available with single or double velocity range scales. Details available. ----------Item 254

FIN AND PIPE COILS. Page 152. Fin and pipe coils of stainless steel solved an acid vapor heating and cooling problem in industry. These coils are ideally suited for handling all types of corrosive air mixtures, gas or liquid for heating or cooling needs. Send details or blueprints for engineering advice. ----------Item 255

FANS. Page 26. This company's new type BL limit-load fan sets new achievements for quietness which is particularly important in certain plants, hospitals, hotels, office buildings, schools, stores, and auditoriums. Bulletins available. ----Item 256

PROPELLER FANS. Page 51. These ventilating fans deliver large volumes of air at low resistance and low current consumption. Made in 2 types and 10 basic sizes to cover a wide range of industrial applications. Wheel diameters from 10 to 48 inches. Direct or belted drive. Bulletins available. ----------Item 257

AIR FILTERS. Page 151. These high velocity air filters have specially hemmed edges for strength and safe, easy handling. Features include maximum efficiency, minimum resistance, no direct air passage and large dust holding capacity. Catalogs available. ----------Item 258

AIR DIFFUSERS. Page 148. Square and rectangular diffusers custom-designed with built-in diffusing vanes in a wide variety of louver patterns. For ceiling or sidewall location. Catalog available. ----------Item 259

AIR DIFFUSERS. Page 149. There is no need to improvise or compromise when you specify these square and rectangular air diffusers which are custom made to suit conditions on each application. Will provide blows in 1, 2, 3 or 4 directions without use of blank-offs. Thirty-four page catalog available. ----------Item 260

AIR FILTER. Page 11. This type of dry air filter introduced in 1936 is now handling ¼ of a billion cubic feet per minute capacity in installations in all types of business. It gives the highest cleaning efficiency of any commercial unit filter and simplified maintenance eliminating oil or water for washing. Uses a paper filtering media. Bulletin available. ----------Item 261

WROUGHT IRON. Page 7. The difference between wrought iron and steel is shown by actual photographs of fractured pieces of the two materials. The tiny threads of iron silicate give wrought iron its unique fiber structure and its superior resistance to corrosion and fatigue stresses. Booklet available. ----------Item 262

HEAT TRANSFER EQUIPMENT. Page 119. This company's line of evaporative condensers and cooling towers stops water waste and saves up to 95% of water normally used. ----------Item 263

DIFFUSER COMBINATION. Page 15. A new way to cut costs and save time on duct take-off installations is this new combination unit which combines volume control, angle ring and equalizing deflector in one unit. This pre-packaged unit cuts installation costs in half. ----------Item 264

AIR CONDITIONING. Page 44. The Mile High Center, a 23-story office building being built in Denver, has chosen this company's system of air conditioning. Source of comfort cooling will be two 800 ton water cooling systems. ----------Item 265

SPLIT BOILER. Page 123. A split sectional boiler for schools, factories, hotels, hospitals and similar buildings and which fits through undersized door openings and avoids annoying head-room snags. It is available in 12 sizes with capacities ranging from 3,650 to 21,250 square foot of steam radiation. Larger sizes are available on request. Details available. ----------Item 266

AIR FILTERS. Page 113. In six years this company has furnished its advanced design self-cleaning automatic air filter for installations whose total capacity is nearly 40 million cfm. Bulletins available. Item 267

Enter numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION

Enter below item numbers on which you wish further information.

Item No.....	Item No.....	Item No.....	Item No.....	Item No.....
Item No.....	Item No.....	Item No.....	Item No.....	

PLEASE PRINT July AD-54

Name .....**Title** .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....**Zone**..... **State**.....

This card is void after Oct. 1, 1954

Ad-Digest SERVICE

CONVECTOR. Page 141. An unmatched combination of beauty, long life, and uniform healthful heating with this line of convector radiation. Bulletin available. ----------Item 268

COOLING AND HEATING UNITS. Page 131. An unusual check list showing the features of this heating and cooling unit which is available in 5 types with 4 fan speeds with coil reversible for right- or left-hand piping and many other features. Bulletin available. ----------Item 269

UNIT HEATERS. Pages 18-19. With this line of unit heaters heat flows evenly over large areas and spreads instant heat on work zones. Available in horizontal type in 11 sizes, in a range of sizes of down-blast heaters, and in 7 sizes of gas-fired type. Catalogs available. ----------Item 270

CONTROL SYSTEM. Page 139. Advertisement features example of the company's control center in a school in which radiant floor panels, unit heaters and finned pipe radiation are combined in a four-zone system to provide effective heating. Temperature is lowered evenings and weekends by time clocks with manual over-ride switches. Adjustable ratio outdoor reset controls position of motor-operated valves, as dictated by outdoor temperatures. Information available. ----------Item 271

MOTORS. Page 27. This company specializes in building motors for products that eliminate waste motion, perform efficiently for the home, farm, business or industry. Standard motors are offered in ratings from 1/20 to 5 hp and hermetic motors ½ to 20 hp. Bulletins available. ----------Item 272

RADIANT HEAT COILS. Page 29. Standard size radiant panel heating grids of copper tube, factory formed, ready to install and shipped in a figure-8 bundle. ⅜ inch coils contain 50 feet of ⅜ inch nominal type L copper tube pre-formed to 6 inch center to center spacing. ½ inch coils contain 50 feet of ½ inch nominal type L tube on 9 inch center to center spacing. Both sizes are also easily hand adjustable to other center to center spacing. Bulletin available. ----------Item 273

FIRE PROTECTION CABINETS. Page 150. A line of interior fire protection equipment including 480 cabinets alone. Information available. ----------Item 274

REFRIGERANT SPECIALTIES. Page 133. Four vital items that can make or break any air conditioning system include the filter drier, solenoid valves, thermostatic expansion valve and refrigerant distributor. Each of these is described in this advertisement as giving peak performance. Information available. ----------Item 275

AIR RECOVERY. Page 37. One of the newest applications of this company's air recovery equipment is in the Springs Cotton Mills' offices in South Carolina. Wherever this air recovery equipment is installed, for every $100 invested in air recovery $400 is saved on initial equipment, and for every dollar spent for maintenance of air recovery equipment there is a $4 savings in operating cost. Information available. ----------Item 276

AIR FILTERS. Page 52. This automatic air filter is the only one designed to give the double protection of double filter curtains, the first wet, the second dry. There is never any oil entrainment and the clean side of curtains is always on the filtered air side. Other features listed. Folder available. ----------Item 277

REFRIGERATION AND AIR CONDITIONING. Page 20. How the new student union building at Indiana University has selected this company's refrigeration equipment including 13 refrigerating machines and a unit air conditioner. Bulletin on this company's line of compressors is available. ----------Item 278

POWDER FASTENERS. Page 138. These powder operated fasteners are as much as four times faster than old fashioned conventional methods of drilling and setting studs for such purposes as fastening pipe and duct hangers to masonry. Specification manual available. ----------Item 279

MOTOR AND STARTER. Page 36. A motor and starter package which gives the most economical motor and starter combination that limits inrush of motor current to values that are acceptable for the distribution systems of most power companies and are particularly applicable to refrigeration and air conditioning compressors. Information available. ----------Item 280

STEEL PIPE. Page 40. When the mechanical threader goes to work on this steel pipe you can depend on it that the threads cut will be perfect and leak-proof. Seven points of uniform goodness in this pipe are listed. ----------Item 281

INSULATION. Page 58. This fiber glass insulation increases efficiency, reduces temperature of outside casing, reduces outside dimensions and minimizes noise when used with heating units. It is easily applied, is light weight, and pliable. Information available. ----------Item 282

COPPER DRAINAGE LINE. Page 24. This copper water tube is economical for soil, waste and vent lines when you count the installed cost and add the costumer satisfaction it brings. Comes in 20 foot lengths, pre-cutting and pre-assembling is practical. ----------Item 283

VALVES. Page 50. This company's 125 pound iron body wedge gate valve has quality features that assure the kind of service you want. Selection includes all iron or brass trimmed valve. Sizes up to 48 inches. ----------Item 284

HEATING EQUIPMENT. Page 59. The most complete line of heating, air conditioning and water heating equipment in the industry. This advertisement features the advantages of local distributor warehousing and service which customers of this company enjoy. ----------Item 285

STEAM GENERATORS. Page 47. Three of these modern integral furnace boilers have replaced five old units at the stamping plant of a prominent manufacturer of heating and plumbing equipment. Overall operating efficiency of these boilers is 85% and each has a steam capacity of 27,500 pounds per hour. Features are listed. Bulletin available. ----------Item 286

AIR FILTER. Page 48. A new air filter which stays clean as new automatically because it has pulse type action. While each panel in a revolving curtain is submerged in the cleaning tank at the bottom, it is agitated vigorously 6 or more times by a compressed air drive. This cleans each panel thoroughly as well as completely renewing the adhesive. Information available. ----------Item 287

PIPE HANGERS. Inside front cover. There's a stock hanger for every piping requirement in this company's line. The hangers permit adjustment after the pipe is erected. This makes it easy for you to correct sagging pipe water traps and so on to provide positive drainage for the system. ----------Item 288

STEAM UNIT HEATERS. Page 38. These unit heaters warm the world's largest bakery in which 122 steam unit heaters have been installed. Available in horizontal or vertical discharge models, direct-fired models and in the gas-fired type. ----------Item 289

BOILER FEEDERS. Back cover. Advertisement lists the ABC's of why high boiler water feeders and low water fuel cut-offs are a good investment. Don't overlook these fundamentals. ----------Item 290

OIL UNIT HEATERS. Page 145. A line of direct-fired oil unit heaters in 10 sizes with capacities from 112,000 to 220,000 Btu per hour capacity and intended for the commercial and industrial heating market. Information available. ----------Item 291

AIR CONDITIONING. Page 55. A full line of heating and air conditioning equipment, including convectors, baseboards, unit heaters, furnace conditioners, air conditioning units, and mobile air conditioners. The line offers quality, economy and efficient performance priced to sell. ----------Item 292

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U.S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING

148 LAFAYETTE STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

HOW TO SAVE MATERIAL and LABOR IN PIPING LAYOUTS

Here is a special fabricating service designed to save time, material and labor in piping systems. By eliminating numerous flanged joints and combining several fittings into one integral unit, as illustrated, Naylor fabrications provide the answer for greater efficiency and economy.

All types of materials can be fabricated accurately to your specifications. Sizes range from 3" to 44" in diameter and wall thicknesses up to ⅜".

Naylor Bulletin No. 525 presents helpful information on this special service. Write for your copy today and submit your problem for recommendation and quotation.

NAYLOR PIPE

Naylor Pipe Company
1265 East 92nd St., Chicago 19, Illinois
Eastern U.S. and Foreign Sales Office
350 Madison Ave., New York 17, N.Y.

Statement of Principles by the Plastics Industry

Plastic materials challenge industry with new concepts of design, engineering, construction, processibility and usefulness.

The properties of plastic materials, when correctly used, open up great new areas of service to industry and the public.

Improper use can do irreparable damage to the plastics industry, to both manufacturers and processors of the materials.

Therefore, we as manufacturers and processors of plastic materials reaffirm our adherence to the principles upon which the healthy growth of a great industry depends and undertake to:

I. Understand thoroughly the properties and limitations of all plastic materials handled by us;

II. Apply the correct plastic materials to all industrial end uses, designing and engineering them for maximum value, performance and safety;

III. Use great care to select the correct plastic materials for all consumer items, designing and engineering them to insure value, satisfaction, safety and pleasure to all users;

IV. Sell plastic materials, and all industrial and consumer items made therefrom, on the merits of the materials, applications and design, and free of extravagant, insupportable claims.

All to the end that plastic materials already available, and others that may come, will bring to industry and public alike all the benefits, economies and satisfactions inherent in these versatile engineering and construction materials.

Manufacturing Chemists' Association, Inc. — President
The Society of Plastics Engineers, Inc. — President
The Society of the Plastics Industry, Inc. — President
Plastic Coatings and Film Association — President
Proprietary Plastics Manufacturers Association — President

Accepted:
The Atlas Mineral Products Co.
Raymond B. Seymour, President

We firmly believe that the practice of these principles which are completely in accord with the ATLAS POLICY will minimize misapplication of Plastic Materials of Construction. Customers should have confidence in firms complying with these principles.

Based on over sixty years adherence to this policy, ATLAS will continue to do all within its power to: Understand thoroughly, Apply correctly, Select carefully, and Sell on merit, all plastic materials for corrosion-proof construction that it produces.

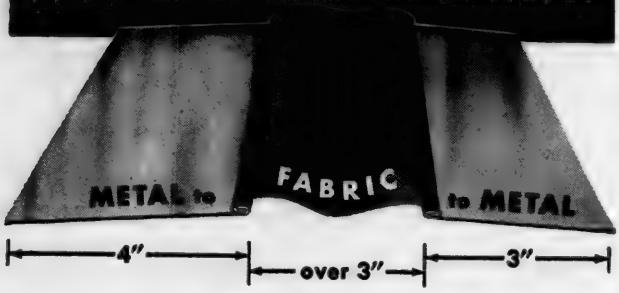
PLASTIC

CEMENTS • COATINGS
RIGID FABRICATIONS • PIPE
LININGS • FOAMS

ATLAS MINERAL PRODUCTS CO.
MERTZTOWN, PENNSYLVANIA

PLASTIC MATERIALS FOR CORROSION-PROOF CONSTRUCTION

NEW! DURO
METAL-FAB
makes quality flexible ducts up to 70% faster than old methods

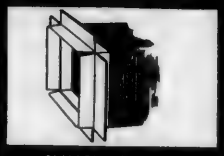


pre-assembled for you metal to fabric to metal!

ONE-PIECE FABRIC AND METAL DUCT CONNECTOR

- For your protection, exclusive "Double-Loc" metal-to-fabric seam
- Fastest, simplest money-saving way to fabricate flexible duct connectors
- Wide metal edges ample to form all types of joints (clinch, flange, slip, etc.)
- Finest engineer-approved materials used throughout
- Required flat lengths quickly pulled from Dispens-o-Flat carton. (Packed in 100 ft. rolls)
- Stops vibration noise in furnaces • blowers • air conditioners • attic fans, etc.
- Duro Stapler eliminates costly sewing of fabric
- Available in U.L. approved Canvas, Asbestos, Neoprened Fiberglas

Typical types of connector made with DURO METAL-FAB


CLINCH COLLAR

FLANGE

SLIP

Write for DURO METAL-FAB Samples and Literature.

DURO-DYNE CORPORATION
800E Third Ave., New Hyde Park, L. I., N. Y.

WHAT WOULD YOU DO?

(*Continued from page* 124)

cleaning operations are to be followed by several water rinses to insure a clean surface.

Molten rosin or lead may be used after first driving a wooden plug into one end. With lead, the tubes are first filled with an oil and the oil drained as previously described. Tubes should be held as nearly vertical as possible when filling and additional filler should be added to feed the shrinkage which develops upon solidification. Then a wooden plug should be driven tightly against the filler and the tube allowed to cool fully before the bend is made. After the bend has been made, the filler can be remelted with torches and emptied.

It is imperative that all traces of rosen or lead and oil used in conjunction with the lead filler be removed from inside the tube. Residue of rosin will be left in the tube unless adequate cleaning is performed. Rosin residues may be thoroughly removed from the inside of tubes by soaking for a short period in a 25 percent concentration of boiling caustic soda. Rosin may become a serious fire hazard if it becomes too hot during the melting. The heating must be kept under control and watched carefully after the rosin is completely melted to prevent boiling or flash point temperatures.

Another Reply

The reader who asks how best to bend a 1½-inch stainless steel pipe on a reasonable radius without kinking or cracking and without benefit of preheat, fails to indicate the wall thickness and the type stainless he is using. We are probably reasonably safe in assuming that it is ordinary material.

Lacking heating equipment, it is hoped that at least mechanical bending equipment is at hand to develop slow, uniform pressure over a smooth mandrel. With this provided, it is suggested that ordinary commercial sulfur be melted over a steam bath and poured into the pipe. When cooled, the bending operation should be completely successful. As a second choice method, clean dry sand may be packed into the pipe to prevent buckling. Be sure to have all the sand run out before releasing the pipe for installation. The bending occasionally compresses the sand and holds it at the turns.

Paul C. Ziemke

Oak Ridge, Tenn.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

TESTING MATERIALS MEETING—Annual meeting and exhibition of the American Society for Testing Materials, at the Sherman Hotel, Chicago, Ill. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. . . . . **JUNE 13-18, 1954.**

REFRIGERATING ENGINEERS MEETING—41st semi-annual meeting of the American Society of Refrigerating Engineers, at the Hotel Olympic, Seattle, Wash. M. C. Turpin, secretary of the Society, 234 Fifth Avenue, New York City. . . . . **JULY 11-14, 1954.**

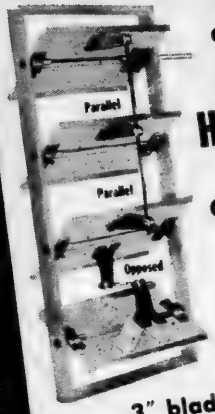
PLANT MAINTENANCE SHOW—Western Plant Maintenance Show at the Pan Pacific Auditorium, Los Angeles, Calif. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. . . . . **JULY, 13-15, 1954**

(*Concluded on page* 146)

SAVE TIME, MONEY and MAINTAIN TOP QUALITY *DURO-DYNE* PRODUCTS

"DURO-BLADE KIT"

precision engineered **DAMPER HARDWARE**



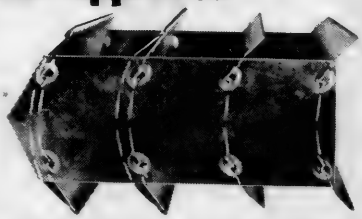
- Swiftest, simplest assembly
- Ideal for light or heavy dampers, 3" blades or wider
- Corrosion-resistant throughout
- Parallel or opposed blade action
- Can be screwed, bolted, riveted, welded, spot welded

the original, job-tested

"DURO-VANE RAIL"

fast, accurate least expensive way to make engineer-approved AIR TURNING VANES

Installed Cost cut 50% to 70%



- Complete turning Vanes meet engineering specifications
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- Eliminates layout
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YOU can successfully sell COMMERCIAL and INDUSTRIAL Heating!

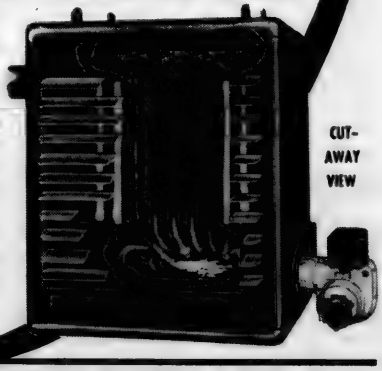
Even if you have never sold commercial or industrial heating before . . . you can do it now . . . with no increase in overhead and no change in your current operation!

Now you can get in on BIG PROFITS with the World's First

Delta DIRECT-FIRED OIL UNIT HEATER*

Delta has designed an entirely new heating system, available in 10 sizes from 112,000 to 220,000 BTU/hr for wide open spaces and large buildings — that any dealer can install in a few hours.

To learn how easy it is to clean up in commercial heating, write for complete details.



CUT-AWAY VIEW

*Patents Pending

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NEW *Aerovent* *Mancooler* FANS

for spot cooling of men and machines drying • exhausting • general ventilating

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other models for every air-moving requirement

Certified Ratings

All Aerovent Fans are rated in accordance with the Standard Test Code and U.S.D.C. Comm. Std. CS178-51.

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Aerovent Fan Company, Inc.
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How Jenn-Air | LOW CONTOUR exhausters cut costs 35%

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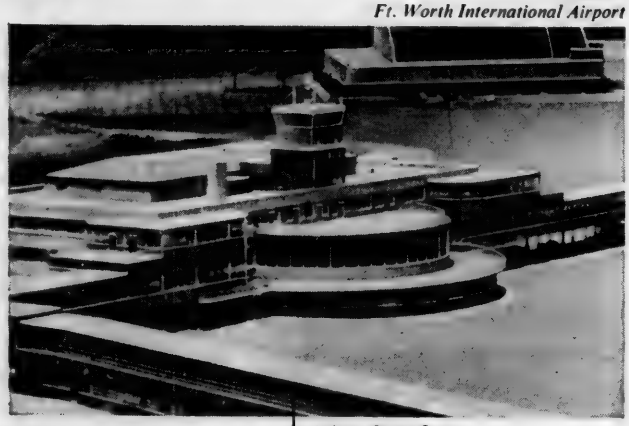
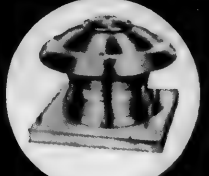


Architect, Preston Geren; Consulting Engineer, Yendell-Cowan-Love; Mechanical Contractor, General Engineering Corp.

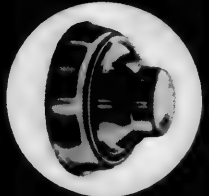
PROBLEM: To ventilate office, restroom and locker areas, holding costs at a minimum, conserving inside space, providing spot ventilation in building segments and blending equipment into beauty of structure.

SOLUTION: The adapting of two types of exhausters throughout structure . . . wall exhausters where structural make-up of building prevented going to the roof . . . roof exhausters where they could be spotted immediately over areas to be ventilated.

Result: a saving of 35% in labor and material.



Low contour roof exhausters blend with architectural design of building.



Wall exhausters architecturally sculptured button design spots ventilation control.

WHY JENN-AIR? Only Jenn-Air could offer the diversification and adaptability of two types of exhausters, fitting ventilation to building need, instead of the building conforming to the ventilation problem.

Low contour Jenn-Air Exhausters, made of ageless spun aluminum, are non-rusting – provide strength without weight. Next time consult Jenn-Air Ventilating Specialists on your ventilating problems.

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Architects & Builders Bldg.
Indianapolis 4, Ind.

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Architects & Builders Building - Indianapolis 4, Indiana
Please send me your free catalog 53B.

name_____

title_____

company_____

address_____

city_____ state_____ HV

(*Concluded from page* 144)

SANITARY ENGINEERS MEETING—48th annual meeting of the American Society of Sanitary Engineering, at the Muehlebach Hotel, Kansas City, Mo. Walter A. Dunn, secretary of the Society, 4716 Ewins Ave. S., Minneapolis, Minn. . . . . **AUGUST 8-12, 1954.**

METEOROLOGICAL SOCIETY MEETING—130th meeting of the American Meteorological Society, at the Rochester Chamber of Commerce, Rochester, N. Y. Secretary of the Society, 5 Joy St., Boston 8, Mass. . . . . **AUGUST 24-25, 1954.**

ASME MEETING—Fall meeting of the American Society of Mechanical Engineers, at the Schroeder Hotel, Milwaukee, Wis. Secretary of the Society, 29 West 39th St., New York, N. Y. . . . . **SEPTEMBER 8-10, 1954.**

CHEMICAL SOCIETY MEETING—126th national fall meeting of the American Chemical Society, in New York City. R. M. Warren, secretary of the Society, 1155 Sixteenth St. N.W., Wash. 6, D. C. . . . . **SEPTEMBER 12-17, 1954.**

INTERNATIONAL INSTRUMENT CONGRESS—First International Instrument Congress and Exposition, sponsored by The Instrument Society of America, to be held in the Commercial Museum and Convention Hall, Philadelphia, Pa. Richard Rimbach, managing director of the Exposition, 845 Ridge Ave., Pittsburgh 12, Pa. . . . . **SEPTEMBER 13-25, 1954.**

PLUMBING AND HEATING CONVENTION—Third annual convention of the American Institute of Wholesale Plumbing & Heating Supply Associations, at New Orleans, La. George T. Underwood, executive secretary, 402 Albee Bldg., Washington, D. C. . . . . **SEPTEMBER 19-22, 1954.**

AGA CONVENTION—Annual convention of the American Gas Association, at Convention Hall, Atlantic City, N. J. Secretary of the Association, 420 Lexington Ave., New York, N. Y. . . . . **OCTOBER 11-13, 1954.**

ELECTRICAL ENGINEERS MEETING—Fall general meeting of the American Institute of Electrical Engineers, at the Hotel Morrison, Chicago, Ill. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. . . . . **OCTOBER 11-15, 1954.**

SAFETY CONGRESS AND EXPOSITION—42nd National Safety Congress and exposition, of the National Safety Council, at Chicago, Ill. R. L. Forney general secretary of the Council, 425 No. Michigan Ave., Chicago 11, Ill. . . . **OCTOBER 18-22, 1954.**

ASA CONFERENCE—Fifth national conference on Standards and 36th annual meeting of the American Standards Association, at the Roosevelt Hotel, New York, N. Y. Secretary of the Association, 70 East 45th St., New York 17, N. Y. . . . . **NOVEMBER 15-17, 1954.**

REFRIGERATION ENGINEERS CONVENTION—17th Annual convention of the Refrigeration Service Engineers Society, at the Raddison Hotel, Minneapolis, Minn. Secretary of the Society, 2577 No. Teutonia Ave., Milwaukee 6, Wis. . . . . **NOVEMBER 18-21, 1954.**

ASME MEETING—Annual meeting of the American Society of Mechanical Engineers, at the Statler Hotel, New York City. Secretary of the Society, 29 W. 39th St., New York City. . . . . **NOVEMBER 28-DECEMBER 3, 1954.**

POWER SHOW—21st National Exposition of Power and Mechanical Engineering, at the Comercial Museum, Philadelphia, Pa., to be held under the auspices of The American Society of Mechanical Engineers. Charles F. Roth, manager of the Exposition, 480 Lexington Ave., New York 17, N. Y. . . . . **DECEMBER 2-7, 1954.**

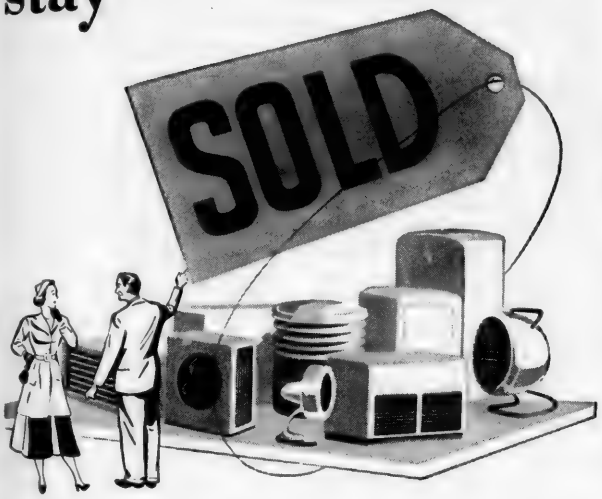
NATIONAL RETAIL INDUSTRY SHOW—First National Retail Industry Show of the Store Modernization Institute, combined with the 5th Store Modernization Show at Madison Square Garden, New York, N. Y. John W. H. Evans, secretary of the Institute and managing director of the Show, 20 E. 55th St., New York, N. Y. . . . . **JANUARY 7-11, 1955.**

SOLAR ENERGY SYMPOSIUM—A world symposium on applied solar energy, sponsored by Stanford Research Institute, Stanford, Calif. at the Westward Ho Hotel, Phoenix, Ariz. Chairman of the Institute, 612 S. Flower St., Room 332, Los Angeles 14, Calif. . . . . **JANUARY 12-15, 1955.**

HEATING & VENTILATING EXPOSITION—12th International Heating & Ventilating Exposition, at the Commercial Museum and Convention Hall, Philadelphia, Pa., held under the auspices of the American Society of Heating and Ventilating Engineers. Charles F. Roth, manager of the Exposition, 480 Lexington Ave., New York 17, N. Y. . . . . **JANUARY 24-28, 1955.**

LUBRICATION ENGINEERS MEETING—Annual meeting and exhibit of the American Society of Lubrication Engineers, at the Hotel Sherman, Chicago, Ill. Wm. P. Youngclaus, Jr., secretary of the Society, 84 E. Randolph St., Chicago 1, Ill. . . . . **APRIL 13-15, 1955.**

Your Products stay



...if they have dependable

Redmond MOTORS

And the reason for this is REDMOND performance. 50,000,000 Redmond MicroMotors have been in use for the last 25 years, establishing a customer acceptance based on that very feature—dependable performance.

These popular power packages are compact and simple in design . . . precision engineered for long-life and trouble-free service. They have selectively fitted self-aligning porous bronze bearings, and their impregnated windings are highly resistant to oil and moisture. These motors offer the manufacturer the latest developments in electric motor design. Smooth-running and dependable . . . with outstanding Tri-Flux and Uni-Cast features.

Redmond offers a wide selection of motors in sizes from 1/500 to 1/6 h.p. and blowers from 50 to 280 CFM.

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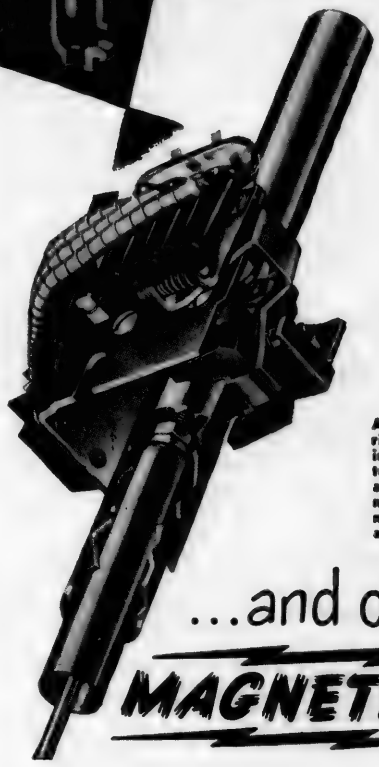
There's No Time Limit on BOILER SAFETY!



A magnetic sleeve, rising and falling within a non-magnetic tube, "trips" or releases an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

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Gives You a Boiler Water Level Control with UNLIMITED OPERATING LIFE

In Magnetrol you have a control mechanism that eliminates the causes of eventual failure *inherent in other controls*. Gone completely are the bellows, diaphragms, electrodes, packing boxes and glands that *must* fail or require servicing sooner or later.

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Gentlemen: Please send me Catalog Section 111 and full information on Magnetrol Boiler Water Level Controls.

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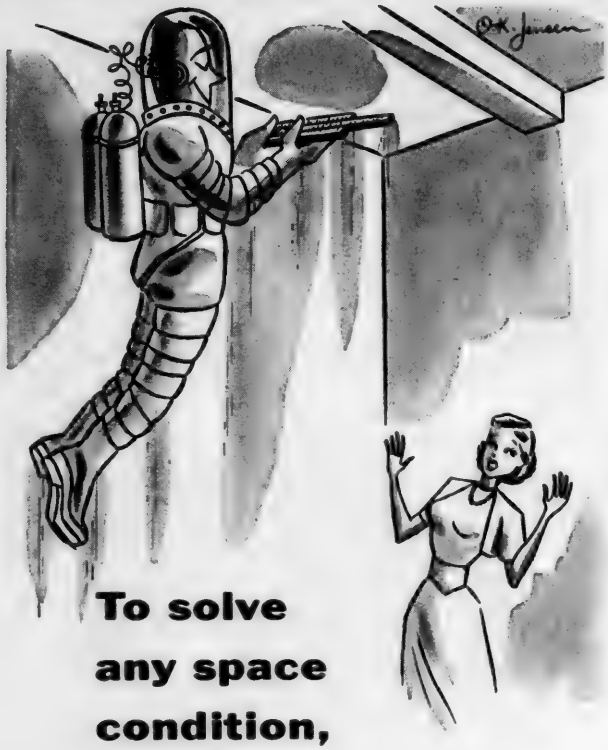

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185 Madison Avenue, New York 16, N. Y.

AIR DIFFUSERS • FILTERS • EXHAUSTERS

DEGREE DAYS FOR MAY, 1954

(A) Airport readings; (C) city office readings;
(O) Readings at a point on outskirts of city.

HEATING AND VENTILATING'S 26th Year of Publication of Monthly Degree-Day Data

City	May		
	1954	1953	Normal
Abilene, Texas (A)	63	72	0
Albany, New York (A)	301	183	246
Albuquerque, New Mexico (A)	59	200	70
Alpena, Michigan (C)	498	403	437
Anaconda, Montana (C)	(a)	614	517*
Asheville, North Carolina (C)	238	30	105
Atlanta, Georgia (A)	105	8	20
Atlantic City, New Jersey (C)	201	116	189
Augusta, Georgia (A)	66	0	0
Baltimore, Maryland (C)	112	38	73
Billings, Montana (A)	356	424	304
Binghamton, New York (C)	295	180	240
Birmingham, Alabama (A)	95	7	30
Bismarck, North Dakota (A)	420	390	355
Block Island, Rhode Island (A)	346	285	335
Boise, Idaho (A)	203	395	249
Boston, Massachusetts (A)	287	215	236
Bozeman, Montana (C)	(a)	574	471*
Buffalo, New York (A)	335	276	315
Burlington, Iowa (A)	261	203	179
Burlington, Vermont (A)	320	231	307
Butte, Montana (C)	(a)	607	502*
Cairo, Illinois (C)	103	48	47
Charleston, South Carolina (C)	5	0	0
Charlotte, North Carolina (A)	118	1	29
Chattanooga, Tennessee (A)	132	15	45
Cheyenne, Wyoming (A)	444	530	462
Chicago, Illinois (C)	305	225	254*
Cincinnati, Ohio (C)	184	30	108
Cleveland, Ohio (A)	263	129	223
Columbia, Missouri (A)	189	127	135
Columbia, South Carolina (C)	51	0	0
Columbus, Ohio (C)	258	73	153
Concord, New Hampshire (A)	345	247	316
Concordia, Kansas (C)	201	194	146
Dallas, Texas (A)	55	42	0
Dayton, Ohio (A)	267	88	179
Deer Lodge, Montana (C)	(a)	582	487*
Denver, Colorado (A)	256	353	286
Des Moines, Iowa (A)	274	203	201
Detroit, Michigan (A)	313	188	251
Devils Lake, North Dakota (C)	503	391	394
Dodge City, Kansas (A)	221	201	135
Dubuque, Iowa (A)	354	261	267
Duluth, Minnesota (C)	637	516	487
Eastport, Maine (C)	(a)	493	524
Elkins, West Virginia (A)	354	72	224
El Paso, Texas (A)	13	64	0
Ely, Nevada (A)	331	687	418
Erie, Pennsylvania (C)	(a)	232	273
Escanaba, Michigan (C)	562	445	471
Evansville, Indiana (A)	189	53	90
Fargo, North Dakota (A)	456	331	338
Fort Smith, Arkansas (A)	101	52	24
Fort Wayne, Indiana (A)	299	133	226
Fort Worth, Texas (A)	57	42	5
Fresno, California (A)	15	127	43
Galveston, Texas (C)	9	0	0
Grand Junction, Colorado (A)	97	276	145
Grand Rapids, Michigan (A)	363	214	301
Green Bay, Wisconsin (A)	468	339	347
Greensboro, North Carolina (A)	174	7	50
Greenville, South Carolina (A)	109	2	32
Harrisburg, Pennsylvania (A)	194	71	128
Hartford, Connecticut (A)	251	164	201
Hatteras, North Carolina (C)	34	2	25
Havre, Montana (C)	341	420	313
Helena, Montana (A)	386	516	399
Houston, Texas (C)	13	3	0
Huron, South Dakota (A)	401	298	279
Indianapolis, Indiana (A)	250	79	176
Jackson, Mississippi (A)	70	3	0
Kansas City, Missouri (A)	153	149	111
Knoxville, Tennessee (A)	162	21	50
La Crosse, Wisconsin (A)	354	228	250
Lander, Wyoming (A)	368	542	396
Lansing, Michigan (A)	380	195	287
Lewiston, Maine (O)	405	240	344*
Lincoln, Nebraska (C)	245	193	172
Little Rock, Arkansas (A)	68	40	18

City	May		
	1954	1953	Normal
Livingston, Montana (C)	(a)	568	405*
Los Angeles, California (C)	47	82	68
Louisville, Kentucky (A)	188	34	94
Lynchburg, Virginia (A)	201	12	82
Macon, Georgia (A)	48	1	0
Madison, Wisconsin (C)	370	267	266
Marquette, Michigan (C)	631	461	477
Memphis, Tennessee (A)	81	31	24
Meridian, Mississippi (A)	77	0	9
Milwaukee, Wisconsin (A)	415	302	351
Minneapolis, Minnesota (A)	369	237	259
Moline, Illinois (A)	291	204	199
Montgomery, Alabama (A)	35	3	0
Nantucket, Massachusetts (A)	398	345	394
Nashville, Tennessee (A)	152	14	43
New Haven, Connecticut (A)	298	196	261
New Orleans, Louisiana (C)	B	0	0
New York, New York (C)	198	116	153
Newark, New Jersey (A)	192	107	148
Norfolk, Virginia (A)	112	2	59
North Head, Washington (C)	(a)	(a)	406
North Platte, Nebraska (A)	341	299	243
Oak Ridge, Tennesee (C)	189	21	(a)
Oakland, California (A)	180	227	212
Oklahoma City, Oklahoma (C)	132	103	38
Omaha, Nebraska (A)	235	186	175
Parkersburg, West Virginia (C)	207	29	119
Peoria, Illinois (A)	247	172	192
Philadelphia, Pennsylvania (C)	145	71	93
Phoenix, Arizona (A)	4	5	0
Pittsburgh, Pennsylvania (C)	220	48	137
Pittsfield, Massachusetts (A)	(a)	269	336
Pocatello, Idaho (A)	249	494	317
Portland, Maine (A)	419	341	394
Portland, Oregon (C)	203	276	199
Providence, Rhode Island (A)	297	214	258
Pueblo, Colorado (A)	194	274	203
Raleigh, North Carolina (A)	144	0	29
Rapid City, South Dakota (A)	349	293	357
Reading, Pennsylvania (C)	172	71	123
Red Bluff, California (A)	13	128	51
Reno, Nevada (A)	201	527	318
Richmond, Va. (A)	151	4	66
Rochester, New York (A)	330	254	289
Roswell, New Mexico (A)	47	108	28
Sacramento, California (C)	27	143	85
St. Joseph, Missouri (A)	204	178	101
St. Louis, Missouri (C)	156	68	94
Salt Lake City, Utah (A)	163	367	233
San Antonio, Texas (A)	10	19	0
San Diego, California (A)	57	94	97
Sandusky, Ohio (C)	268	148	217
San Francisco, California (C)	264	265	248
Sault Ste. Marie, Michigan (A)	812	435	499
Savannah, Georgia (A)	23	0	0
Scranton, Pennsylvania (C)	255	142	196
Seattle, Washington (C)	247	275	246
Sheridan, Wyoming (A)	394	476	387
Shreveport, Louisiana (A)	47	16	0
Sioux City, Iowa (A)	284	209	228
Spokane, Washington (A)	299	383	330
Springfield, Illinois (A)	219	99	127
Springfield, Missouri (A)	184	125	118
Syracuse, New York (A)	290	225	247
Tacoma, Washington (C)	(a)	(a)	282
Terre Haute, Indiana (A)	237	89	145
Toledo, Ohio (A)	317	149	245
Topeka, Kansas (C)	165	163	112
Trenton, New Jersey (C)	192	108	133
Utica, New York (O)	95	91	44
Valentine, Nebraska (C)	312	230	253*
Walla Walla, Washington (C)	344	324	288
Washington, D. C. (C)	155	232	171
Wichita, Kansas (A)	132	16	80
Williston, North Dakota (C)	156	156	101
Winnemucca, Nevada (A)	432	433	360
Yakima, Washington (A)	238	550	299
	229	306	205

(a) Data not available.
*Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

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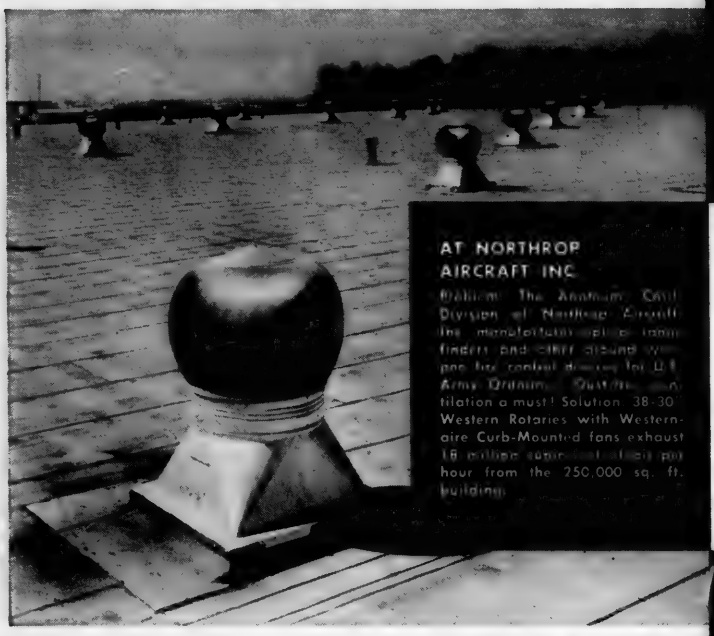

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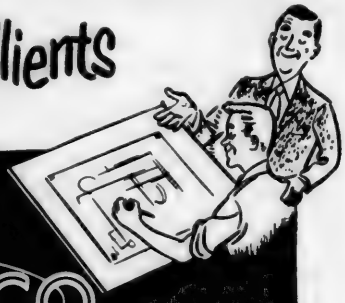

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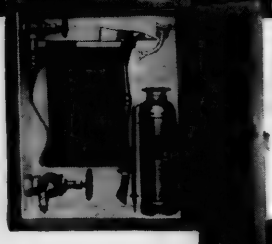

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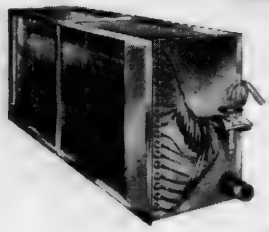

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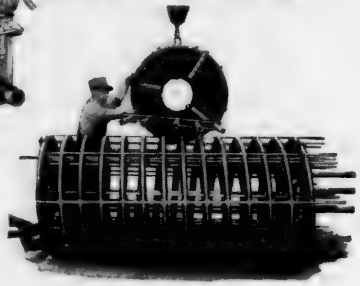

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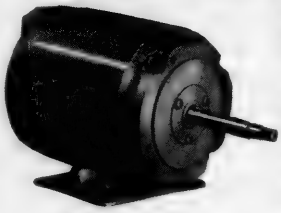

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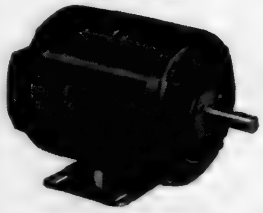

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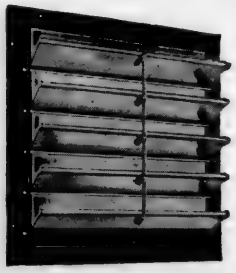

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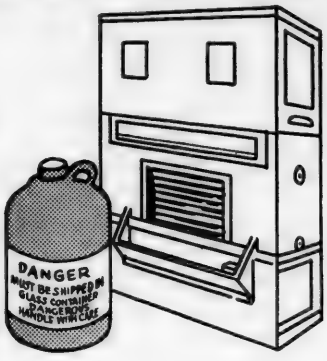

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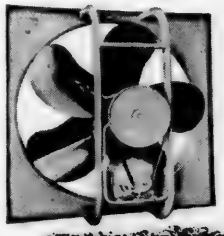

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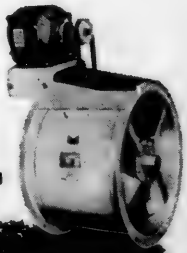

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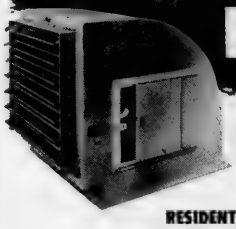

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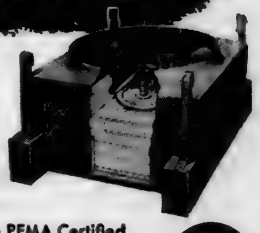

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Gage	Weight of Glavanized Steel Duct per Lineal Foot																Gage
16		15.08	15.53	15.98	16.43	16.88	17.33	17.78	18.23	18.68	19.13	19.58	20.03	20.48	21.15	21.60	16
18		12.28	12.65	13.02	13.38	13.75	14.12	14.48	14.85	15.22	15.58	15.95	16.32	16.68	17.23	17.60	18
20		9.49	9.78	10.06	10.34	10.63	10.91	11.19	11.48	11.76	12.04	12.33	12.61	12.89	13.32	13.60	20
22		7.82	8.05	8.29	8.52	8.75	8.99	9.22	9.45	9.67	9.92	10.15	10.40	10.62	10.97	11.20	22
24		6.70	6.90	7.10	7.30	7.50	7.70	7.90	8.10	8.30	8.50	8.70	8.90	9.10	9.40	9.60	24
26		5.02	5.18	5.33	5.47	5.63	5.78	5.92	6.08	6.23	6.37	6.53	6.68	6.82	7.05	7.20	26
Width of Duct, Inches	Square Feet of Duct Surface per Lineal Foot of Duct																Width of Duct, Inches
		5.33	5.50	5.67	5.83	6.00	6.17	6.33	6.50	6.67	6.83	7.00	7.17	7.33	7.50	7.67	
	Height of Duct, Inches																
16		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	16
17	30		16	17	18	19	20	21	22	23	24	25	26	27	28	29	17
18	29	30		16	17	18	19	20	21	22	23	24	25	26	27	28	18
19	28	29	30		16	17	18	19	20	21	22	23	24	25	26	27	19
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25	22	23	24	25	26	27	28	29	30		16	17	18	19	20	21	25
26	21	22	23	24	25	26	27	28	29	30		16	17	18	19	20	26
27	20	21	22	23	24	25	26	27	28	29	30		16	17	18	19	27
28	19	20	21	22	23	24	25	26	27	28	29	30		16	17	18	28
29	18	19	20	21	22	23	24	25	26	27	28	29	30		16	17	29
30	17	18	19	20	21	22	23	24	25	26	27	28	29	30		16	30
Gage	Square Feet of Duct Surface per Lineal Foot of Duct																Gage
	7.83	8.00	8.17	8.33	8.50	8.67	8.83	9.00	9.17	9.33	9.50	9.67	9.83	10.00			
	Weight of Galvanized Steel Duct per Lineal Foot																
26	7.35	7.50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	9.00	9.15	9.38			26
24	9.80	10.00	10.20	10.40	10.60	10.80	11.00	11.20	11.40	11.60	11.80	12.00	12.20	12.50			24
22	11.43	11.67	11.90	12.13	12.37	12.60	12.84	13.08	13.30	13.53	13.77	14.00	14.23	14.60			22
20	13.88	14.17	14.45	14.73	15.02	15.30	15.58	15.87	16.50	16.43	16.72	17.00	17.28	17.71			20
18	17.97	18.33	18.70	19.07	19.43	19.80	20.17	20.53	20.90	21.27	21.63	22.00	22.37	22.92			18
16	22.05	22.50	22.95	23.40	23.85	24.30	24.75	25.20	25.65	26.10	26.55	27.00	27.45	28.13			16

WEIGHTS OF GALVANIZED STEEL DUCTS—16 × 31 TO 30 × 45 IN.

Gage	Weight of Galvanized Steel Duct per Lineal Foot																Gage
16		22.05	22.50	22.95	23.40	23.85	24.30	24.75	25.20	25.65	26.10	26.55	27.00	27.45	28.13	28.58	16
18		17.97	18.33	18.70	19.07	19.43	19.80	20.17	20.53	20.90	21.27	21.63	22.00	22.37	22.92	23.28	18
20		13.88	14.17	14.45	14.73	15.02	15.30	15.58	15.87	16.15	16.43	16.72	17.00	17.28	17.71	17.99	20
22		11.43	11.67	11.90	12.13	12.37	12.60	12.84	13.08	13.30	13.53	13.77	14.00	14.23	14.60	14.81	22
24		9.80	10.00	10.20	10.40	10.60	10.80	11.00	11.20	11.40	11.60	11.80	12.00	12.20	12.50	12.70	24
26		7.35	7.50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	9.00	9.15	9.38	9.52	26
Width of Duct, Inches	Square Feet of Duct Surface per Lineal Foot of Duct																Width of Duct, Inches
		7.83	8.00	8.17	8.33	8.50	8.67	8.83	9.00	9.17	9.33	9.50	9.67	9.83	10.00	10.17	
	Height of Duct, Inches																
16		31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	16
17	45		31	32	33	34	35	36	37	38	39	40	41	42	43	44	17
18	44	45		31	32	33	34	35	36	37	38	39	40	41	42	43	18
19	43	44	45		31	32	33	34	35	36	37	38	39	40	41	42	19
20	42	43	44	45		31	32	33	34	35	36	37	38	39	40	41	20
21	41	42	43	44	45		31	32	33	34	35	36	37	38	39	40	21
22	40	41	42	43	44	45		31	32	33	34	35	36	37	38	39	22
23	39	40	41	42	43	44	45		31	32	33	34	35	36	37	38	23
24	38	39	40	41	42	43	44	45		31	32	33	34	35	36	37	24
25	37	38	39	40	41	42	43	44	45		31	32	33	34	35	36	25
26	36	37	38	39	40	41	42	43	44	45		31	32	33	34	35	26
27	35	36	37	38	39	40	41	42	43	44	45		31	32	33	34	27
28	34	35	36	37	38	39	40	41	42	43	44	45		31	32	33	28
29	33	34	35	36	37	38	39	40	41	42	43	44	45		31	32	29
30	32	33	34	35	36	37	38	39	40	41	42	43	44	45		31	30
Gage	Square Feet of Duct Surface per Lineal Foot of Duct																Gage
	10.33	10.50	10.67	10.83	11.00	11.17	11.33	11.50	11.67	11.83	12.00	12.17	12.33	12.50			
	Weight of Galvanized Steel Duct per Lineal Foot																
26	9.68	9.84	9.98	10.11	10.29	10.41	10.58	10.72	10.88	11.02	11.18	11.31	11.48	11.70			26
24	12.90	13.10	13.30	13.50	13.70	13.90	14.10	14.30	14.50	14.70	14.90	15.10	15.30	15.60			24
22	15.05	15.28	15.51	15.75	16.00	16.20	16.45	16.68	16.92	17.15	17.38	17.61	17.86	18.20			22
20	18.28	18.56	18.84	19.13	19.41	19.69	19.98	20.26	20.54	20.83	21.11	21.39	21.68	22.10			20
18	23.65	24.02	24.38	24.75	25.12	25.48	25.85	26.22	26.58	26.95	27.32	27.68	28.05	28.60			18
16	29.03	29.48	29.93	30.38	30.83	31.28	31.73	32.18	32.63	33.08	33.53	33.98	34.43	35.10			16

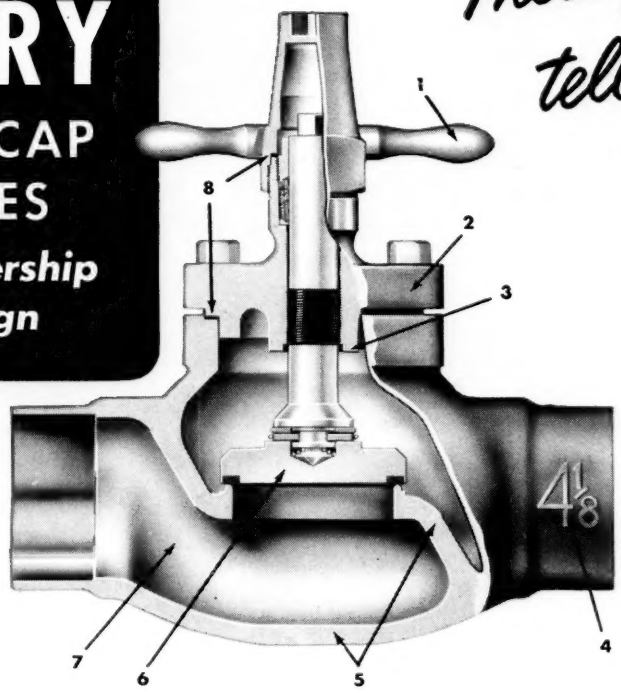
Back of the Unprecedented demand for

HENRY

WING CAP VALVES

is a Leadership in design

These features tell the story



1. WING CAP—with stem operating socket.
2. BOLTED BONNET for maximum safety.
3. BACK SEATING—can be repacked under pressure.
4. VALVE SIZE IDENTIFICATION—on Bronze body.
5. HEAVY WALL—Bronze alloy or Semi-steel for maximum strength.
6. PATENTED, NON-ROTATING SELF-ALIGNING SWIVEL DISC. Easy positive sealing. Minimum seat wear. Chatterproof.
7. FULL CAPACITY FLOW THROUGHOUT.
8. FULLY RETAINED POSITIVE SEALING GASKETS.

Available in bronze alloy and semi-steel types. Sizes range: ⅞" to 5⅛" O.D.S. and ½" to 2" F.P.T. Flanged valves available with brass O.D.S. or steel butt weld adapters, sizes 1⅜" to 5⅛".

Year after year Henry Wing Cap Valves become more popular on both government and civilian refrigeration and air conditioning installations because of the high inherent quality of the valves and their features of design and construction. No other similar product carries such a universal recommendation by wholesalers or is in such wide demand among contractors and service men where the use of a wing cap valve is indicated.

HENRY VALVE CO.

Melrose Park, Ill. (Chicago Suburb)

Cable: HEVALCO, MELROSE PARK, ILLINOIS

HENRY VALVE CO. CONTROLLING FLOW SINCE 1914 ®

Valves, Driers, Strainers, Control Devices and Accessories for Refrigeration and Air Conditioning and Industrial Applications

Don't forget the A-B-C's that sell boiler feeders

Everyone in the business knows that every steam boiler needs boiler water level control as much as it needs a water glass.

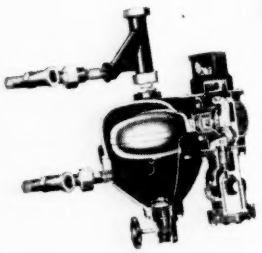
But now and then you run into the boiler owner who says: "It hasn't happened to me; I'll run the risk and save the dough."

That's the time it pays to get down to the A-B-C's of why boiler water feeders and low water fuel cut-offs are a good investment.

We are listing some of the basic "whys" here. Don't overlook these fundamentals. They start the sale off . . . and McDonnell quality clinches it.

McDONNELL & MILLER, INC.
3500 N. Spaulding Ave., Chicago 18, Illinois

Doing One M&W SAFETY CONTROLS *Thing Well*



And for those automatic jobs: A feeder-cut-off combination is a "must."

By its very nature automatic firing encourages an out-of-sight, out-of-mind attitude that can lead to troubles. The feeder cut-off combination makes the boiler water level as automatic as the firing—provides the two basic means of protection in one dependable unit:

1 **MECHANICAL CONTROL.** Feeding water to replace water evaporated.

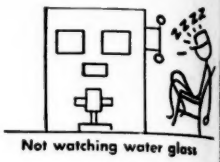
2 **ELECTRICAL CONTROL.** Stopping burner in the event of an emergency which causes the water level to fall into the danger zone.

There is a McDonnell Feeder-Cut-off Combination for every need. Ask for up-to-the-minute facts.

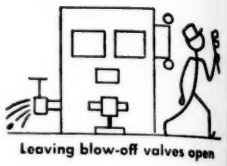
Your Jobber Stocks Them

Carelessness or inattention

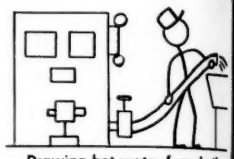
Not watching water glass
Leaving blow-off valves open
Drawing hot water from boiler
Draining without stopping firing



Not watching water glass



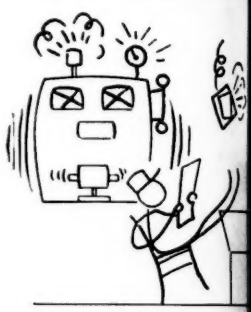
Leaving blow-off valves open



Drawing hot water from boiler

Overfiring of boiler

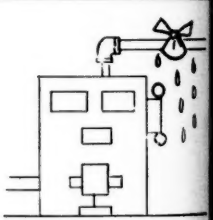
Loss of water through safety valve discharge



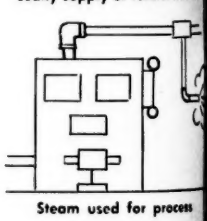
Runaway firing

Defects in system

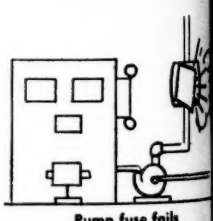
Leaking air valves
Pump stoppage
Leaky supply or return
Condensate held up in system
Faulty check valves
Foaming or priming
Returns not pitched properly
Boiler leaks
Automatic control failure
Process use of steam; no condensate returned



Leaky supply or return line



Steam used for process



Pump fuse fails

McDONNELL

Boiler Water Level Controls